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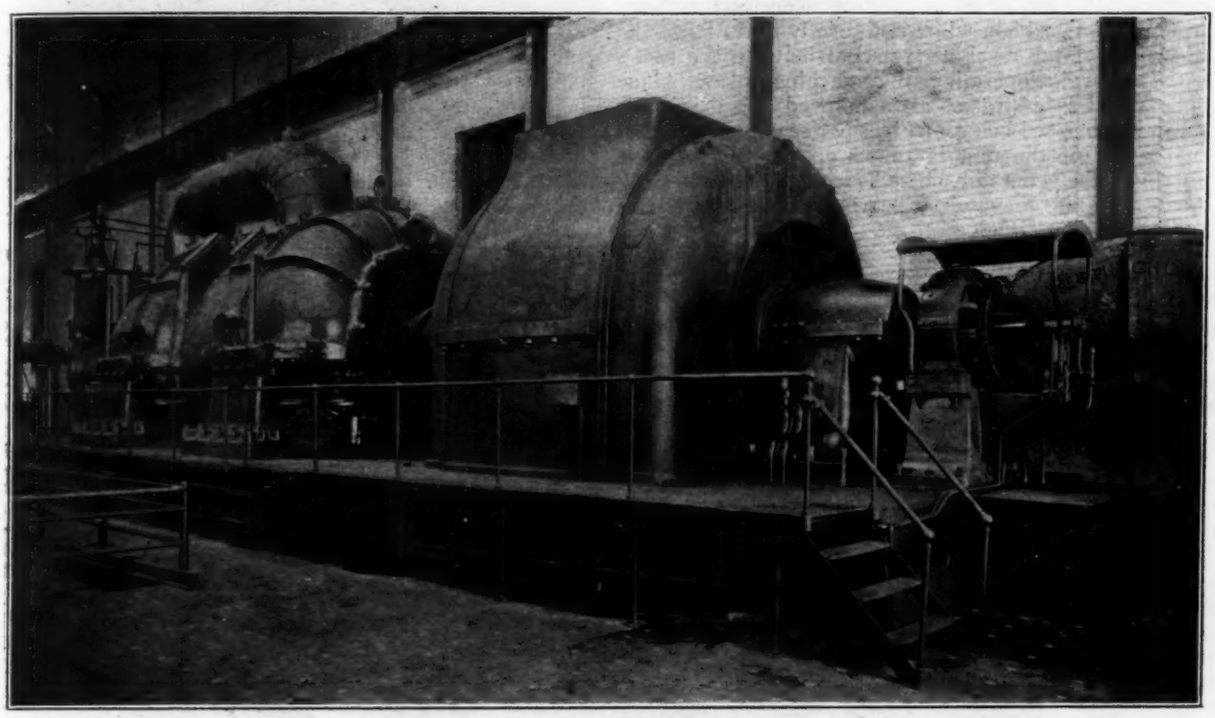


Fig. 1.—35,000-Kilowatt Westinghouse Tandem-Compound Turbogenerator at Northwest Station of Commonwealth Edison Co.

New Generating Equipment at Chicago

Commonwealth Edison Company Installing Two New 35,000-Kilowatt Turbogenerators—Other Additions Necessary Because of War Demands

THE insatiate demands of war have caused tireless activity in many a central station in the endeavor to keep pace with the demands for more and more energy. It is almost invariably the case that a unit is ordered, far in advance of the need, but invariably before the unit is installed it is necessary to start preparing for still more units. This is the story of many of the large central stations, and always has been, even in ante-bellum days.

The Commonwealth Edison Company is no exception, and both the Northwest and Fisk Street stations are scenes of activity. At Northwest one 35,000-kilowatt turbogenerator has recently been placed in service and another goes into service shortly. At the Fisk Street station preparation is shortly to be made for the reception of two additional units, known respectively as Units 12 and 13, which when installed will complete the fifteenth turbogenerator in this station. Meanwhile plans are under way to rewind the generator of Unit 11 during the summer months.

For service in its Northwest Station, the Commonwealth Edison Company of Chicago ordered two 35,000-kilowatt tandem-compound, turbogenerators from the Westinghouse Electric & Manufacturing Company of East Pittsburgh, Pa. One of these machines has been in regular operation since early in October of last year, while the second one is now being erected. In addition a third unit of the same capacity is under construction in the East Pittsburgh works for installation in the Fisk Street Station, Chicago.

The two units for the Northwest Station, to be known as units Nos. 5 and 6, respectively, are identical. Each comprises a high-pressure turbine element, a low-pressure turbine element, and a 35,000-kilovolt-ampere alternating current generator. The two turbine elements are connected by a solid flange coupling and the generator in turn is connected through a flexible coupling so that all three rotors turn as one unit. There are five main bearings, three on the turbine and two on the generator. A small additional bearing is mounted on the outboard end of the direct-connected exciter to support the exciter armature, as shown in Fig. 1.

The unit is designed for 200 pounds steam pres-

sure, superheat of 200 degrees Fahrenheit, and 29 inches vacuum. At an output of 25,000 kilowatts the efficiency ratio is understood to be 75.4 and the steam consumption 10.65 pounds per kilowatt-hour.

The turbine of Unit 6 is of the well-known Westinghouse reaction type throughout. Its design is, however, entirely new. The prime considerations were reliability, high efficiency and the convenience of the operating force in handling and maintaining the apparatus. A number of refinements were incorporated in the design, which, while not strictly essential to the operation of the machine, yet contribute to the user's satisfaction in operating the machine. Low blade speeds and safe stresses are employed, the maximum mean blade speed being 510 feet per second. The normal speed of the unit is 1200 r. p. m. for 60 cycle energy at the generator. The bearing speeds and pressures are quite low and all bearings are served by the usual Westinghouse system of oil circulation and cooling. Steam passages throughout the turbines are liberal, having been designed for a steam velocity not to exceed 100 feet per second at any point, and the passages through the low-pressure blades and exhausts to the condensers are ample to permit full expansion of the steam to 29 inches of vacuum. The shaft packing consists of the well-known water gland with a steam labyrinth added, by means of which it is feasible to established full vacuum before placing the turbine in operation. After sufficient speed is attained, the water gland is put in operation and the steam labyrinth shut off. The water for these glands is preferably obtained from the condensate, as scale-forming water is most objectionable on account of the evaporation that takes place due to heat transfer along the cylinder walls and to fluid friction.

The high-pressure element, which contains the governor and valve mechanism, is of the standard single-flow, pure-reaction construction. In this cylinder, which contains 90 rows of stationary and rotating blading, the steam expands from the throttle pressure of 230 pounds down to a pressure which varies with the load, being approximately 40 pounds absolute at rated full load and 34 pounds absolute at most economical load. It then passes through an exhaust at the top of the cylinder into an overhead passage, illustrated in Fig. 2, which leads to the low-pressure element. The high-pressure rotor has only one bearing, the end of the spindle next to the low-pressure element being carried on the low-pressure bearing. The high-pressure and low-pressure shafts are rigidly connected by means of a solid flange coupling. This end of the high-pressure cylinder is carried as a support on the low-pressure cylinder close to the bearing. A small dummy bearing is provided for carrying the free end of the spindle while dismantling or making adjustments, and means are provided for adjusting the position of the high-pressure cylinder to secure perfect alinement with the low-pressure cylinder.

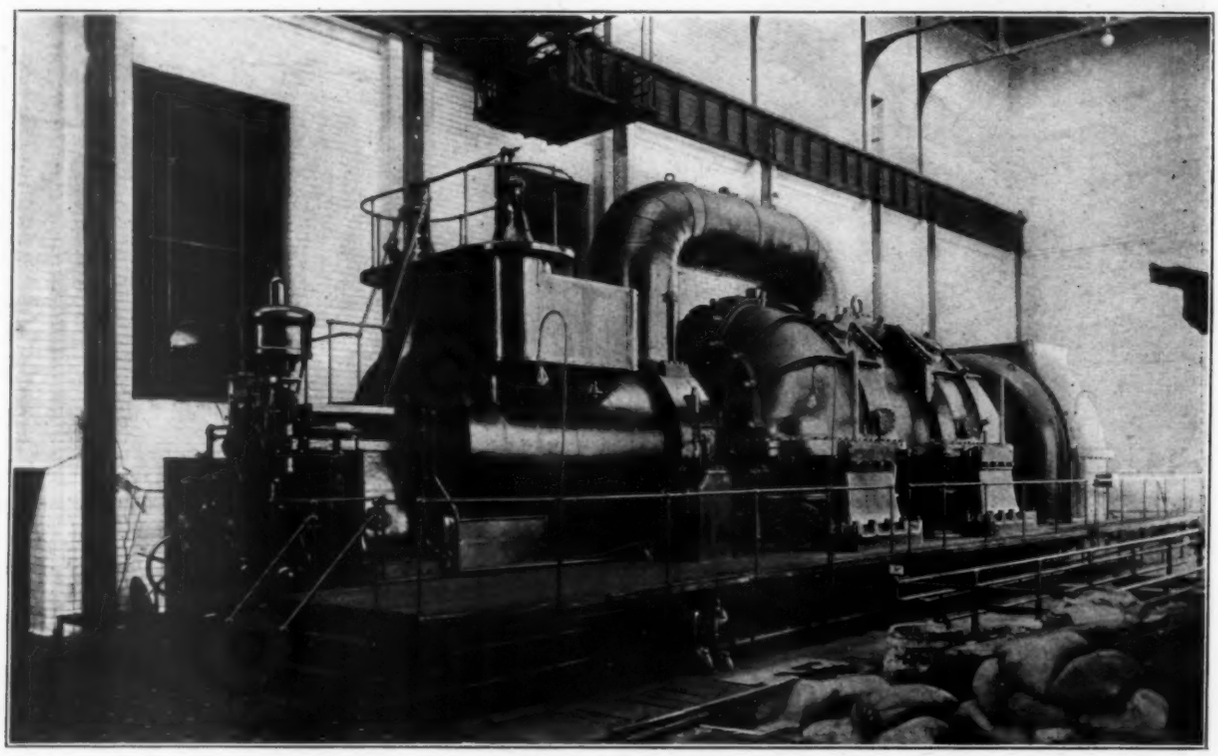


Fig. 2.—35,000 Kilowatt Westinghouse Tandem-Compound Turbo generator From the Steam End.

The high-pressure spindle consists of a hollow steel drum carrying the necessary blading and two small dummies for balancing the end thrust. The two separate shaft ends are rigidly attached to it by means of long press fits and held in place by means of bolts or shrink links. At the governor end there is a Kingsbury thrust bearing just outside of the main bearing for carrying a small portion of the thrust and maintaining proper longitudinal alinement of the rotor and stator. The cylinder, or stator, is made of cast steel to best withstand the high temperature and pressure of the entering steam. Most of the blading is carried on blade rings rigidly attached to the main cylinder, this construction enabling the use of plain sound castings free from distortional stresses.

The low-pressure element, shown in course of erection in Fig. 3, is a combination of a single and double-flow construction, also employing all-reaction blading.

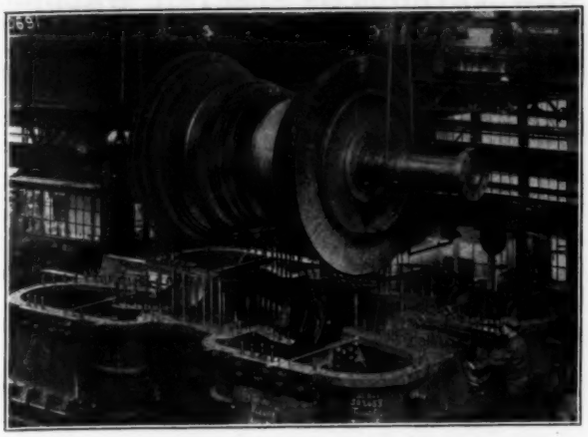


Fig. 3.—View of Low-pressure Spindle in Course of Assembly.

The steam from the high-pressure element enters at the top near the center through the overhead passage referred to above and shown in Fig. 2, and passes through a single-flow stage of 20 stationary and rotating rows of blades, the steam expanding from between 40 and 34 pounds absolute to about 8.5 pounds absolute in doing so. The steam then divides, one half continuing through an adjacent low-pressure stage while the other half passes back around the single flow stage through passages between the inner and outer cylinders to the double low-pressure stage on the opposite end of the spindle. Each low-pressure stage has its separate exhaust passage to the condenser. Between the intermediate stage and the second low-pressure stage there is a labyrinth packing to prevent the flow of steam from the inlet direct to the low-pressure stage.

The low-pressure spindle is built up of a central hollow drum carrying the intermediate stage blading and labyrinth packing and is rigidly attached to the two shaft ends. Upon each of these shaft ends are mounted two discs carrying the low-pressure blading. The low-pressure cylinder, or stator, is entirely of cast iron and made up of a center section and two end sections, keyed and bolted together. Each of these sections is split horizontally, the top half of all three being normally handled as one piece. The intermediate stage blading is carried on an inner cylinder separated from the outer cylinder sufficiently to provide space for the passage of steam to one of the low-pressure stages. The shortest blade in the low-pressure element is 6 inches long, while the longest is 18 inches.

Steam admission is controlled by means of standard Westinghouse control mechanism, consisting of a powerful but sensitive governor controlling the main or primary steam admission valve and two overload valves through an oil relay. The designed capacity on the primary valve is 25,000 kilowatts, this being the point of maximum efficiency. Designed capacity of the secondary is 30,000 kilowatts, and of the tertiary 35,000 kilowatts. The actual capacities of the unit now in operation are between 5 and 10 per cent greater. The governor mechanism is illustrated in Fig. 4.

The condensing outfit comprises two shells of 28,000 square feet, each shell serving one low-pressure element, making a total of 56,000 square feet. Altogether there are 12,972 tubes, 1 inch in diameter and 16½ feet in length. In the upper portion of each condenser, 1200 square feet of tubing is used for heating condensate, that is, as a primary heater, the condensate from the bottom of the condenser is pumped through this portion of the tubes so that the condensate is heated to substantially the temperature of the exhaust steam.

Each of the shells is equipped with a hotwell and air pump of the Leblanc type. These two pumps, illustrated in Fig. 5, are driven on the same shaft by a 139-horsepower Westinghouse turbine. The capacity of the condensate pumps are 1200 gallons per minute each. Each auxiliary pumping unit is capable of supplying the condenser alone at full load, thus permitting one of either units being taken out of service for repairs or emergency.

A single bi-rotor circulating pump, having a capacity of 60,000 gallons per minute against a head of 18 feet, furnishes the circulating water for both condensers. This pump, which is shown in Fig. 6, is driven by a 600-horsepower 440-volt Westinghouse induction motor running at 350 r. p. m.

Generator.

The generator for this 35,000 kilovolt-ampere unit is rated at 30,000 kilowatts at 80 per cent power-factor, or 35,300 kilovolt-amperes. It is a 60-cycle, 12,000-volt star-connected machine, operating at 1200 revolutions per minute. The Westinghouse Company's form of mica insulation is used throughout the generator stator. Scattered throughout the stator are six thermocouples and six exploring coils, the purpose of which

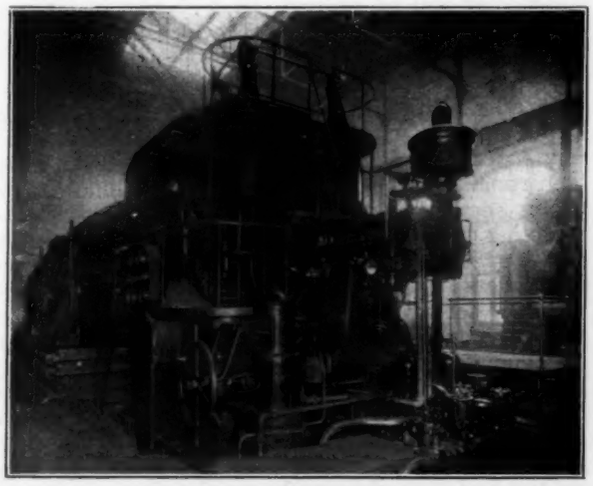


Fig. 4.—Turbine Control Mechanism.

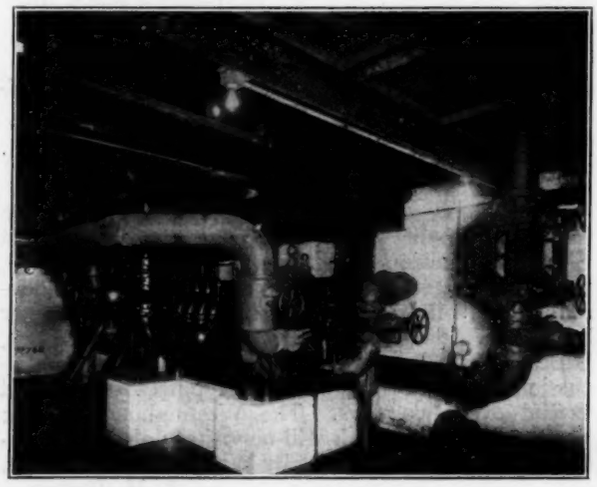


Fig. 5.—Turbine-driven Condensate Pumps in Basement.

is to indicate the temperature of the windings, indicating safe maximum loads, need for cleaning, and so forth. Forced cooling of the generator is employed, a motor-driven blower capable of delivering 120,000

Fig. 6.—Motor-driven Circulating Pump With Two Condenser Shells in Background.

cubic feet of air per minute being used for the purpose. Air washers and humidifyers condition the air.

The exciter is a shunt-wound 250-volt machine of 110 kilowatts,

PLANT AT PERU, ILL., TO BE ENLARGED.

The municipal electric plant at Peru, Ill., is being enlarged by the installation of a new unit of 500 kilowatts capacity. The new equipment consists of an Ames-Stump uniflow valve, 200-horsepower engine, to be coupled direct to a Ft. Wayne General Electric alternating current generator, and a belt-connected exciter set. The three original units consist of a Bates engine, direct-connected to a General Electric, 200-kilowatt direct-current generator; a Westinghouse-Parsons 250-kilowatt-ampere turbogenerator, 2500 volts, 60 cycle, 3 phase; a Westinghouse synchronous motor-generator set of 100-kilowatts, direct-current. The plan is gradually to change to alternating current. All units will be run in parallel. The energy produced is almost entirely for lighting purposes. there being about 1200 meters on the system.

ENGLISH CONVENTION TO DISCUSS FUTURE OF ELECTRIC POWER SUPPLY.

It has been decided to again defer the meetings of the British Association for the Advancement of Science which were to have taken place in August or September of this year. The Incorporated Municipal Electrical Convention, however, will be held as usual, though the meetings will be modified. The presidential address will be delivered on June 20 at Manchester by S. J. Watson, borough electrical engineer of Bury, Lancashire. There will be no papers read, but a discussion on the future of electric power supply will extend over two days. The Westinghouse electric works at Trafford Park will be visited; also the Manchester Corporation Electricity Works at Stuart Street.

A. H. Bridge.

NEW METHODS OF ELECTRIC WELDING.

Innovations in electric welding processes are shown in a group of six United States patents recently issued as numbers 1,259,270 to 1,259,275, inclusive, of which the first four were granted to Thomas E. Murray, Jr., of Brooklyn, N. Y., while the last two were granted to Thomas E. Murray, of New York City. Instead of following the older plan of simultaneously heating both of the metal tips or other parts which are to be adjoined, these patents call for heating one or both parts separately to a plastic state and then pressing the parts together.

For making a flat ring, the metal is formed into a truly circular form with the ends overlapped; these ends are then heated electrically to render them viscous and are compressed together to a sectional area uniform with the rest of the ring, and finally the excess of metal extended at the joint is removed.

In welding a thin plate flatwise to another metal plate, either one or both of the plates may be heated to a plastic state, after which the plates are pressed together. The same is done for butt welds, where the tips of the metal pieces are heated separately and independently of each other until they become plastic, after which the pieces are moved into contact and pressed together.

The patents also include one on an electric welding machine in which rotating electrodes progressively draw the joint between them, and on a process of electrical molding. For the latter purpose, a body of metal is inserted through openings in the walls of a mold, after which the body is heated electrically to a plastic state and is then compressed endwise to fill the mold. Finally, the heating current is interrupted and the sections of the mold are separated to remove the molded metal body.

WATER POWER DEVELOPMENT IN DENMARK.

Difficulties of importing coal have developed many heretofore unprofitable sources of power, heat, and light. The most important of these is the peat bogs in the western part of Denmark. In Norway and Sweden water power is developed to a great extent for the production of electricity, but in Denmark there are no waterfalls of consequence. It is reported that Gudenaa, a small river in the vicinity of Aarhus, is about to be developed by the municipality of Aarhus at a cost of $1,000,000. It is expected that about 1000 horsepower will be utilized. It will take about one year to put it into operation, provided the necessary equipment can be obtained.

Public Utility Problems Given Publicity.—The Illinois Electric Association, the Illinois Electric Railway Association and the Illinois Gas Association have been running in a number of prominent Illinois daily papers some very interesting and timely appeals acquainting the public with problems which confront the public utility companies. In a recent appeal, the three associations quote at full length the letter which Secretary McAdoo wrote to President Wilson, regarding the stability of public utilities and the imperative need of maintaining them at a high state of efficiency during the period of the war. The answer which President Wilson sent to Secretary McAdoo is also quoted at full length and some interesting comment follows regarding the present financial dilemma in which many utilities find themselves at the present time.

Studies in Wood, Steel and Concrete Pole-Line Costs

Continuation of Comparative Cost Studies of Cedar, Chestnut, Steel and Concrete Poles—Advantages of Preservative Treatment for Wood Poles—Detailed Factors Entering Into Pole-Line Costs

By F. L. HAUSHALTER

[*The first part of this article was published in the* ELECTRICAL REVIEW *of April 6, 1918, page 587. In it were discussed the fundamental considerations on which the calculation of the comparative annual charges of wood poles are based. In the second part below is discussed the comparison of charges for treated and untreated poles. In the third part of the article, to appear next week, will be discussed costs of steel and concrete poles.*]

The manner of comparing the charges for treated and untreated poles is now simple. The preservative treatment is supposed to prolong the life of the pole 12 years. The preservative acts as an antiseptic that long, but when decay once starts in the pole is eaten away about as rapidly as though it were untreated. The total cost now includes the cost of treatment, this added cost appearing in the item of initial cost for the treated pole. Depreciation and interest charges are arrived at in the same way as before. The tables will show the differences both in annual charges per pole and annual charges per mile between the treated and untreated poles at spacings of 100 and 150 feet, respectively.

Chestnut poles have also been figured. These poles have been considered similar to the northern cedar in stress and taper. The prices obtained for chestnut poles are from the Paducah Pole & Timber Company, of Paducah, Ky., and include freight charges to Columbus, Ohio. It will be noted that the chestnut poles as quoted for the heights of 35 to 55 feet cost less than the cedar poles and hence this causes a sag in the cost curves.

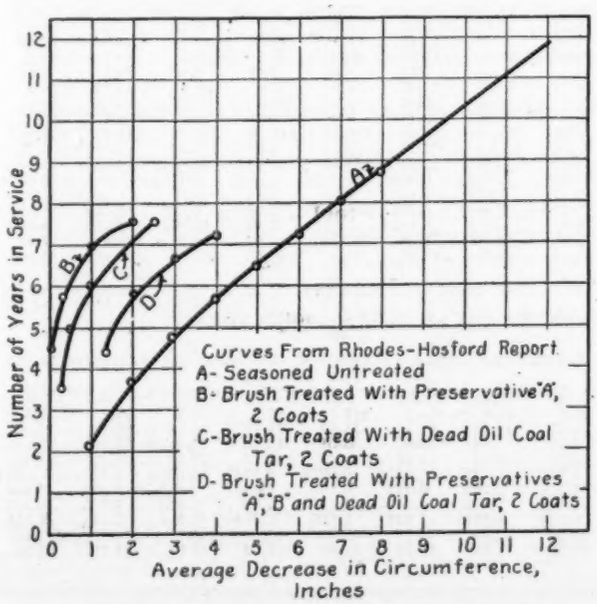

Number of Years in Service
Average Decrease in Circumference, Inches
Curves From Rhodes-Hosford Report
A- Seasoned Untreated
B- Brush Treated With Preservative "A", 2 Coats
C- Brush Treated With Dead Oil Coal Tar, 2 Coats
D- Brush Treated With Preservatives "A", "B" and Dead Oil Coal Tar, 2 Coats

Fig. 1.—Curves Reproduced From Rhodes-Hosford Report.

Labor costs for 20 and 25-foot poles would not be much different but the extra height and weight of poles above 25 feet call for more help in pole setting. On observing the labor costs for the different poles, it may be thought that they are too low. E. B. Hook, superintendent of construction for the Georgia Railway & Power Company, says that he set a number of poles in Georgia by the block-and-tackle method and that the actual labor cost for setting 50-foot creosoted poles was 60 to 75 cents per pole, including the actual setting and tamping in. With a 1.5-ton truck substituted for mules and six or seven men dispensed with he set 50 and 60-foot creosoted poles weighing approximately two tons at an average cost of 33 cents per pole. If these figures mean anything, the labor cost allowed for pole setting in arriving at annual charges will not appear too low.

The saving arrived at in annual charges through treating the poles with "AA" preservative is somewhat different from that given by companies dealing in preservatives. However, their method of showing the

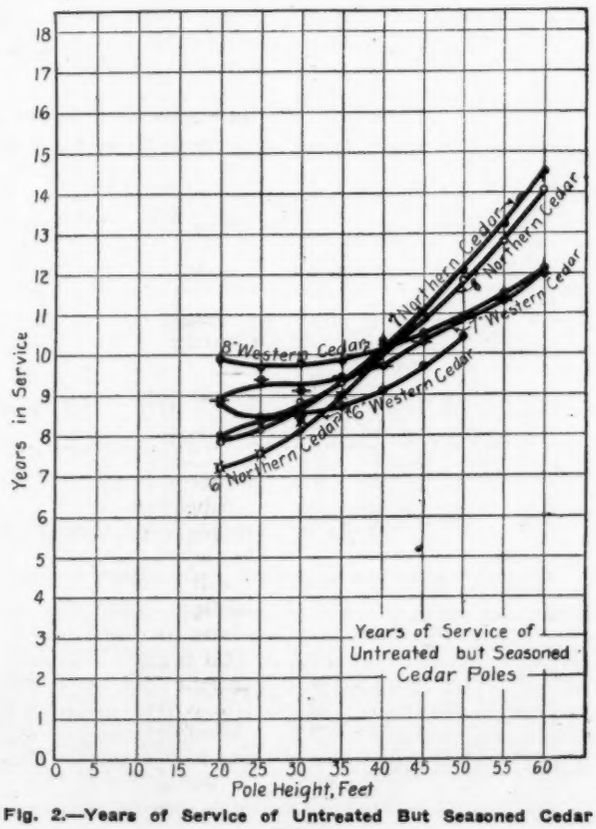


Fig. 2.—Years of Service of Untreated But Seasoned Cedar Poles.

TABLE II.—COMPARATIVE COSTS OF TREATED CEDAR POLES, 8-INCH TOPS.

(A)

Northern White Cedar treated with "AA" creosote treatment. 8-inch tops. Other conditions the same as untreated poles (See Table I).

Length over all, ft	20.	25.	30.	35.	40.	45.	50.	55.	60.
Life if preserved, years	20.8	20.45	20.8	21.22	22.1	22.73	23.9	24.85	26.06
Labor cost per pole	$1.60	$1.65	$2.50	$3.47	$4.43	$4.98	$5.53	$6.37	$7.06
Initial cost	4.50	5.80	10.00	14.95	18.05	22.00	25.85	29.35	33.00
Total cost	6.10	7.45	12.50	18.42	22.48	26.98	31.38	35.72	40.06
Depreciation deposit per $1.00 @ 5 per cent	0.0288	0.0294	0.0288	0.0280	0.0263	0.0252	0.0230	0.0212	0.0197
Depreciation charge	0.175	0.219	0.359	0.515	0.591	0.688	0.720	0.758	0.800
Interest charge	0.366	0.447	0.750	1.105	1.348	1.619	1.880	2.14	2.437
Total annual charge	0.541	0.666	1.109	1.620	1.939	2.307	2.600	2.898	3.237
Cost per mile, 53 poles	28.70	35.30	58.80	85.90	102.90	122.40	137.90	153.50	171.40
Cost per mile, 35 poles	18.92	23.30	38.80	56.70	67.80	80.80	91.00	101.20	113.20

TABLE II (B).

Western Red Cedar treated with "AA" creosote treatment. 8-inch top. Other conditions the same as untreated poles. [See Table I (B).]

Length over all, ft	20	25	30	35	40	45	50	55	60
Life if preserved, years	21.9	21.7	21.8	21.82	22.3	22.5	22.4	23.5	24.1
Labor cost per pole	$1.60	$1.65	$2.50	$3.47	$4.43	$4.98	$5.53	$6.37	$7.06
Initial cost per pole	3.30	4.10	7.60	11.75	13.30	16.30	19.00	21.60	24.50
Total cost per pole	4.90	5.75	10.10	15.22	17.17	21.28	24.53	27.97	31.56
Depreciation deposit per $1.00 @ 5 per cent	0.0267	0.0271	0.0269	0.0270	0.0259	0.0256	0.0258	0.0237	0.0226
Depreciation charge	0.131	0.156	0.272	0.411	0.445	0.545	0.633	0.660	0.713
Interest charge	0.294	0.345	0.605	0.914	1.063	1.278	1.470	1.680	1.890
Total annual charge	0.425	0.501	0.877	1.325	1.508	1.823	2.103	2.340	2.603
Cost per mile of 53 poles	22.50	26.60	46.50	70.50	80.00	96.70	111.50	124.00	138.00
Cost per mile of 35 poles	14.90	17.50	30.63	46.40	52.80	63.80	73.70	81.90	91.00

TABLE III.—COMPARATIVE COSTS OF UNTREATED CEDAR POLES WITH 7-INCH TOPS.

(A)

Northern White Cedar. Tops 7 inches diameter. Taper (t) taken as 0.016 inch per inch. Load 450 pounds 1.5 feet below top. Fiber stress (s) 800 pounds per square inch.

Length over all, ft., $= L$	20.	25.	30.	35.	40.	45.	50.	55.	60.
Depth in ground, ft., $= D$	4.5	4.5	5.0	5.5	6.0	6.5	6.5	7.0	7.0
Moment arm, in., $= L_1 = (L - D - 1.5) \times 12$	168	228	276	336	390	444	504	558	618
External moment $= M = L_1 \times 450$, in.-lbs.	75,600	102,800	127,000	151,200	175,600	199,600	226,600	251,200	278,000
Increase in dia. at ground line $= t \times x$	2.98	3.94	4.80	5.66	6.53	7.38	8.35	9.21	10.18
Diameter at ground line $= 7 + t \times x$, in	9.98	10.94	11.80	12.66	13.53	14.38	15.35	16.21	17.18
Circumference at ground line, in	31.4	34.4	37.1	39.8	42.6	45.2	48.3	51.0	54.0
Diameter at ground line for ½ initial factor safety	7.84	8.68	9.3	9.86	10.36	10.8	11.3	11.7	12.1
Circumference of same	24.6	27.3	29.2	31.0	32.6	34.0	35.5	36.8	38.0
Loss in circumference at ground line allowed, in	6.78	7.12	7.88	8.8	10.02	11.2	12.78	14.2	15.98
Years of service from curves of Hosford	7.8	8.1	8.6	9.3	10.1	11.0	12.1	13.2	14.5
Initial cost cedar pole	$3.18	$3.95	$6.70	$10.60	$13.30	$15.95	$18.80	$20.80	$23.00
Labor cost per pole	1.50	1.52	2.19	3.14	4.13	4.57	5.16	5.68	6.29
Total cost per pole	4.68	5.47	8.89	13.74	17.43	20.53	23.96	26.48	29.29
Depreciation deposit per $1.00@5 per cent	0.1083	0.1033	0.0963	0.0873	0.0786	0.0704	0.0622	0.0554	0.0487
Depreciation charge	0.510	0.565	0.856	1.20	1.37	1.441	1.49	1.467	1.428
Interest charge @ 6 per cent	0.282	0.328	0.534	0.825	1.048	1.230	1.439	1.590	1.760
Total annual charge	0.792	0.893	1.390	2.025	2.418	2.671	2.929	3.057	3.187
Cost per mile of 53 poles	42.00	47.40	73.70	107.10	128.00	141.50	155.20	162.00	169.00
Cost per mile of 35 poles	27.73	31.22	48.60	70.90	84.40	93.40	102.50	106.90	111.50

TABLE III (B).

Western Red Cedar. 7-inch tops. Taper (t) = 1 inch in 8 feet; s = 1600 pounds per square inch. Load 450 pounds 1.5 foot from top.

Length over all, ft., $= L$	20	25	30	35	40	45	50	55	60
Depth in ground, ft., $= D$	4.5	4.5	5.0	5.5	6.0	6.5	6.5	7.0	7.0
Moment arm, in., $= L_1 = (L - D - 1.5) \times 12$	168	228	276	336	390	444	504	558	618
External moment $= M = L_1 \times 450$, in.-lbs.	75,600	102,800	127,000	151,200	175,600	199,600	226,600	251,200	278,000
Increase in dia. at ground line $= t \times x$	1.87	2.56	3.12	3.68	4.25	4.8	5.43	6.0	6.62
Dia. at ground line $= 7 + t \times x$, in	8.87	9.56	10.12	10.68	11.25	11.8	12.43	13.0	13.62
Circumference at ground line, in	27.9	30.6	31.8	33.6	35.37	37.5	39.5	40.81	42.8
Dia. at ground line for ½ initial factor safety	6.23	6.9	7.4	7.85	8.26	8.65	8.96	9.3	9.61
Circumference for same	19.6	21.70	23.24	24.67	26.0	27.2	28.4	29.23	30.2
Loss in circumference at ground line allowed, in	8.3	8.9	8.56	8.93	9.37	10.3	11.1	11.58	12.6
Years of service from Hosford's curves	8.9	9.4	9.1	9.46	9.7	10.3	10.9	11.3	12.
Initial cost cedar pole	$2.30	$2.75	$5.30	$9.15	$10.70	$13.40	$16.30	$18.70	$21.00
Labor cost per pole	1.50	1.52	2.19	3.14	4.13	4.57	5.16	5.68	6.29
Total cost per pole	3.80	4.27	7.49	12.29	14.83	17.97	21.46	24.38	27.29
Depreciation deposit per $1.00 @ 5 per cent	0.0921	0.0862	0.0896	0.0855	0.0829	0.0768	0.0795	0.0681	0.0628
Depreciation charge	0.350	0.368	0.670	1.105	1.23	1.38	1.71	1.658	1.714
Interest charge @ 6 per cent	0.23	0.256	0.449	0.747	0.891	1.08	1.288	1.462	1.638
Total annual charge	0.58	0.624	1.119	1.852	2.121	2.46	2.998	3.120	3.352
Cost per mile of 53 poles	30.72	33.80	59.30	98.20	112.70	125.00	159.00	165 50	177.80
Cost per mile of 35 poles	20.30	21.80	39.18	64.80	74.30	86.00	165.00	109.10	117.20

TABLE IV.—COMPARATIVE COSTS OF TREATED CEDAR POLES, 7-INCH TOPS.

(A)

Northern White Cedar treated with "AA" creosote treatment. 7-inch tops. Other conditions the same as untreated poles. [See Table III (A).]

Length over all, ft	20.	25.	30.	35.	40.	45.	50.	55.	60.
Life if preserved, years	19.8	20.1	20.6	21.3	22.1	23.0	24.1	25.2	26.5
Labor cost per pole	$1.50	$1.52	$2.19	$3.14	$4.13	$4.57	$5.16	$5.68	$6.29
Initial cost	3.83	4.85	7.85	12.05	15.05	18.10	22.05	24.55	27.50
Total cost	5 33	6.37	10.04	15.19	19.18	22.67	27.21	30.23	33.79
Depreciation deposit per $1.00 @ 5 per cent	0.0307	0.0301	0.0291	0.0278	0.0263	0.0247	0.0226	0.0209	0.0191
Depreciation charge	0.164	0.191	0.292	0.422	0.505	0.559	0.616	0.633	0.646
Interest charge	0.320	0.382	0.603	0.911	1.15	1.36	1.633	1.815	2.025
Total annual charge	0.484	0.573	0.895	1.333	1.655	1.919	2.249	2.448	2.671
Cost per mile, 53 poles	25.60	32.00	47.50	70.70	87.80	101.50	119.10	130.00	141.50
Cost per mile, 35 poles	16.92	20.04	31.51	46.70	57.90	67.10	78.70	85.70	93.50

TABLE IV (E).

Western Red Cedar treated with "AA" creosote treatment. 7-inch tops. Other conditions the same as untreated poles. [See Table III (b).]

Length over all, ft.	20	25	30	35	40	45	50	55	60
Life if preserved, years	20.9	21.4	21.1	21.46	21.7	22.3	22.9	23.3	24.
Labor cost per pole	$1.50	$1.52	$2.19	$3.14	$4.13	$4.57	$5.16	$5.68	$6.29
Initial cost per pole	2.30	2.75	5.30	9.15	10.70	13.40	16.30	18.70	21.00
Total cost per pole	3.80	4.27	7.49	12.29	14.83	17.97	21.46	24.38	27.29
Depreciation deposit per $1.00 @ 5 per cent	0.0286	0.0276	0.0282	0.0275	0.0271	0.0259	0.0246	0.0241	0.0228
Depreciation charge	0.108	0.118	0.211	0.338	0.402	0.465	0.528	0.586	0.621
Interest charge @ 6 per cent	0.23	0.256	0.449	0.747	0.891	1.08	1.288	1.462	1.638
Total annual charge	0.338	0.374	0.660	1.085	1.293	1.545	1.816	2.048	2.259
Cost per mile of 53 poles	17.90	19.82	35.00	57.50	69.50	81.90	96.20	108.40	119.20
Cost per mile of 35 poles	11.81	13.09	23.10	38.00	45.20	54.10	63.5	71.70	78.70

TABLE V.—COMPARATIVE COSTS OF UNTREATED CEDAR POLES, 6-INCH TOPS.

(A)

Northern White Cedar. Tops 6 inches diameter. Taper (t) taken as 0.016 inch per inch. Load 100 pounds applied 1.5 feet from top. Fiber stress 800 pounds per square inch.

Length over all, ft., $= L$	20	25.	30.	35.	40.	45.	50.
Depth in ground, ft., $= D$	4.5	4.5	5.0	5.5	6.0	6.5	6.5
Moment arm, in., $= L_1 = (L - D - 1.5) \times 12$	168	228	276	336	390	444	504
External moment $= M = L_1 \times 100$, in.-lbs.	57,200	77,600	93,800	114,200	132,600	151,000	171,400
Increase in diameter at ground line $= t \times x$	2.98	3.94	4.8	5.66	6.53	7.38	8.35
Diameter at ground line $= 6 + t \times x$, in.	8.98	9.94	10.8	11.66	12.53	13.38	14.35
Circumference at ground line, in.	28.2	31.2	33.96	36.6	39.42	42.0	45.1
Diameter at ground line for ½ initial factor safety	7.14	7.9	8.41	9.0	9.45	9.88	10.3
Circumference of same	22.42	24.81	26.42	28.28	29.7	31.03	32.4
Loss in circumference at ground line allowed, in.	5.88	6.39	7.53	8.32	9.72	10.97	12.7
Years of service from Hosford curves	7.2	7.5	8.4	9	10	10.9	12.1
Initial cost pole	$1.61	$2.70	$4.95	$6.70	$10.95	$13.95	$17.00
Labor cost per pole	1.28	1.38	1.93	2.85	3.51	3.88	4.30
Total cost per pole	2.89	4.08	6.88	9.55	14.46	17.83	21.30
Depreciation deposit per $1.00 @ 5 per cent	0.1192	0.1138	0.0991	0.0907	0.0795	0.0713	0.0622
Depreciation charge	0.344	0.464	0.681	0.856	1.150	1.271	1.324
Interest charge @ 6 per cent	0.173	0.245	0.413	0.573	0.868	1.070	1.279
Total annual charge	0.517	0.709	1.094	1.429	2.018	2.341	2.603
Cost per mile of 53 poles	27.40	37.60	58.00	75.60	106.90	124.00	138.00
Cost per mile of 35 poles	18.10	24.80	38.30	49.90	70.50	82.00	91.00

TABLE V (B).

Western Red Cedar. 6-inch top. Taper (t) = 1 inch in 8 feet; s = 1600 pounds per square inch. Load 100 pounds 1.5 feet from top. Same conditions as Northern Cedar.

Length over all, ft., $= L$	20	25	30	35	40	45	50
Depth in ground, ft., $= D$	4.5	4.5	5.0	5.5	6.0	6.5	6.5
Moment arm, in., $= L_1 = (L - D - 1.5) \times 12$	168	228	276	336	390	444	504
External moment in.-lbs. $= M = L_1 \times 100$	57,200	77,600	93,800	114,200	132,600	151,000	171,400
Increase in dia. at ground line $= t \times x$	1.87	2.56	3.12	3.68	4.25	4.79	5.41
Diameter at ground line $= 6 + t \times x$	7.87	8.56	9.12	9.68	10.25	10.79	11.41
Circumference at ground line, in.	24.8	27.2	28.64	30.4	32.2	33.9	35.9
Dia. at ground line for ½ initial factor safety	5.66	6.28	6.69	7.14	7.5	7.84	8.18
Circumference of same	17.80	19.73	21.00	22.4	23.6	24.6	25.7
Loss in circumf. at ground line allowed, in.	7.0	7.4	7.64	8.0	8.6	9.3	10.2
Years of service from Hosford's curves	8.0	8.4	8.6	8.7	9.1	9.7	10.3
Initial cost cedar pole	$1.50	$2.30	$4.10	$6.30	$10.45	$13.00	$16.15
Labor cost per pole	1.28	1.38	1.93	2.85	3.51	3.88	4.30
Total cost per pole	2.78	3.68	6.03	9.15	13.96	16.88	20.45
Depreciation deposit for $1.00 @ 5 per cent	0.1047	0.0991	0.0963	0.0949	0.0896	0.0828	0.0768
Depreciation charge	0.291	0.365	0.580	0.869	1.250	1.397	1.571
Interest charge @ 6 per cent	0.167	0.221	0.362	0.549	.848	1.011	1.228
Total annual charge	0.458	0.699	0.942	1.418	2.098	2.408	2.799
Cost per mile of 53 poles	24.28	31.03	49.90	75.00	111.00	127.80	148.10
Cost per mile of 35 poles	16.03	20.50	33.00	49.60	73.40	84.40	98.00

TABLE VI.—COMPARATIVE COSTS OF TREATED CEDAR POLES, 6-INCH TOPS.

(A)

Northern White Cedar treated with "AA" treatment of creosote. 6-inch tops. Other conditions the same as untreated. [See Table V (A).]

Length over all, ft.	20.	25.	30.	35.	40.	45.	50.
Life if preserved, years	19.2	19.5	20.4	21	22	22.9	24.1
Labor cost per pole	$1.28	$1.38	$1.93	$2.85	$3.51	$3.88	$4.30
Initial cost	2.11	3.50	5.95	7.90	12.50	15.70	19.75
Total cost	3.39	4.88	7.88	10.75	16.01	19.58	24.05
Depreciation deposit per $1.00 @ 5 per cent	0.0323	0.0315	0.0295	0.0284	0.0265	0.0249	0.0226
Depreciation charge	0.109	0.154	0.232	0.305	0.425	0.486	0.545
Interest charge	0.203	0.293	0.472	0.645	0.960	1.174	1.444
Total annual charge	0.312	0.447	0.704	0.950	1.385	1.660	1.989
Cost per mile, 53 poles	16.55	23.70	37.30	50.40	73.50	88.00	105.20
Cost per mile, 35 poles	10.88	15.64	24.60	33.25	48.50	58.10	69.50

TABLE VI (B).

Western Red Cedar treated with "AA" creosote treatment. 6-inch tops. Other conditions the same as untreated poles. [See Table V (B).]

Length over all, ft.	20	25	30	35	40	45	50
Life if preserved, years	20.	20.4	20.6	20.7	21.1	21.7	22.3
Labor cost per pole	$1.28	$1.38	$1.93	$2.85	$3.51	$3.88	$4.30
Initial cost per pole	1.95	2.90	4.80	7.20	11.55	14.40	17.70
Total cost per pole	3.23	4.28	6.73	10.05	15.05	18.28	22.00
Depreciation deposit per $1.00 @ 5 per cent	0.03024	0.0295	0.0291	0.0289	0.0282	0.0271	0.0260
Depreciation charge	0.097	0.1265	0.196	0.291	0.425	0.495	0.572
Interest charge @ 6 per cent	0.194	0.257	0.403	0.604	0.905	1.096	1.320
Total annual charge	0.291	0.3835	0.599	0.895	1.330	1.591	1.892
Cost per mile of 53 poles	15.41	19.80	31.75	47.50	70.50	84.40	100.20
Cost per mile of 35 poles	10.18	13.40	20.98	31.30	46.60	56.70	67.50

TABLE VII.—COMPARATIVE COSTS OF UNTREATED CHESTNUT POLES.

Chestnut poles under same conditions of service as the Northern White Cedar poles (See Tables I, III and V). 7 and 8-inch tops. Same taper, (t) = 0.016 inch per inch; hence same life, since same rate of decay.

Length over all, ft.	20	25	30	35	40	45	50	55	60
Initial cost 8-inch top	$5.50	$7.50	$9.25	$10.75	$11.75	$13.75	$16.25	$19.75	$24.75
Labor cost	1.60	1.65	2.50	3.47	4.43	4.98	5.53	6.37	7.06
Total cost	7.10	9.15	11.75	14.22	16.18	18.73	21.78	26.12	31.81
Depreciation charge at 0.10832 per $1.00	0.77	1.048	1.273	1.256	1.27	1.364	1.383	1.5	1.616
Interest charge @ 6 per cent	0.426	0.549	0.705	0.854	0.97	1.125	1.305	1.568	1.91
Total annual charge	1.196	1.597	1.978	2.110	2.24	2.489	2.688	3.068	3.526
Cost per mile, 53 poles	63.50	84.70	104.80	113.80	118.80	132.00	142.50	162.80	187.00
Initial cost 7-inch top	4.65	6.40	7.75	9.25	10.75	11.75	13.75	16.25	22.75
Labor cost	1.50	1.52	2.19	3.14	4.13	4.57	5.16	5.68	6.29
Total cost	6.15	7.92	9.94	12.39	14.88	16.32	18.91	21.93	29.04
Depreciation @ 0.10834 per $1.00	0.666	0.818	0.956	1.08	1.168	1.15	1.175	1.212	1.411
Interest charge @ 6 per cent	0.369	0.475	0.596	0.743	0.892	0.98	1.135	1.317	1.744
Total annual charge	1.035	1.292	1.552	1.823	2.060	2.13	2.310	2.529	3.155
Cost per mile, 53 poles	54.80	68.50	82.40	96.70	109.10	113.00	122.4	134.00	167.10
Cost per mile, 35 poles	36.20	45.40	54.40	63.80	72.10	74.50	80.90	88.50	110.40

TABLE VIII.—COMPARATIVE COSTS OF TREATED CHESTNUT POLES.

Chestnut poles preserved with "AA" creosote treatment. Same conditions as cedar poles of taper (t) = 0.016 inch per inch. Depreciation rate same as for cedar.

Length over all, ft.	20	25	30	35	40	45	50	55	60
Initial cost 8-inch top	$6.00	$8.20	$10.30	$12.05	$13.25	$15.50	$18.25	$22.25	$27.75
Labor cost	1.60	1.65	2.50	3.47	4.43	4.98	5.53	6.37	7.06
Total cost	7.60	9.85	12.80	15.52	17.68	20.48	23.78	28.62	34.81
Depreciation charge	0.2183	0.29	0.368	0.434	0.455	0.515	0.546	0.608	0.686
Interest charge @ 6 per cent	0.456	0.591	0.768	0.931	1.06	1.239	1.424	1.72	2.091
Total annual charge	0.674	0.881	1.136	1.365	1.515	1.754	1.970	2.328	2.777
Cost per mile, 53 poles	35.70	46.70	60.20	72.40	80.40	93.00	104.40	123.40	147.00
Initial cost 7-inch top	5.10	1.00	8.70	10.40	12.05	13.35	15.55	18.50	25.40
Labor cost	1.50	1.52	2.19	3.14	4.13	4.57	5.16	5.68	6.29
Total cost	6.60	8.52	10.89	13.54	16.18	17.92	20.71	24.18	31.69
Depreciation charge	0.203	0.255	0.316	0.377	0.426	0.442	0.469	0.505	0.606
Interest charge @ 6 per cent	0.396	0.511	0.653	0.813	0.97	1.075	1.243	1.451	1.901
Total annual charge	0.599	0.766	0.969	1.190	1.396	1.517	1.712	1.956	2.507
Cost per mile, 53 poles	31.70	40.60	51.40	63.10	74.00	80.40	90.70	103.70	133.00
Cost per mile, 35 poles	20.97	26.80	33.90	41.60	48.80	53.00	60.00	68.40	87.70

saving is considerably different from that carried out in this article. For instance, one company shows the comparative saving due to treatment by the open-tank method of a 7-inch top, 35-foot pole as follows:

Average cost per pole set in line estimated at $10.00.

The life of the untreated pole is taken at 14 years and 14 years is assumed to be added to the life by treating it.

UNTREATED.

Principal	$10.00
Interest at 7 per cent for 14 years	9.80
Advance of 20 per cent in cost of pole at end of first 14 years	2.00
Replacement of pole	10.00
Interest at 7 per cent for 14 years	11.76
Total cost per pole for 28 years	$43.56
Cost per year per pole	1.56

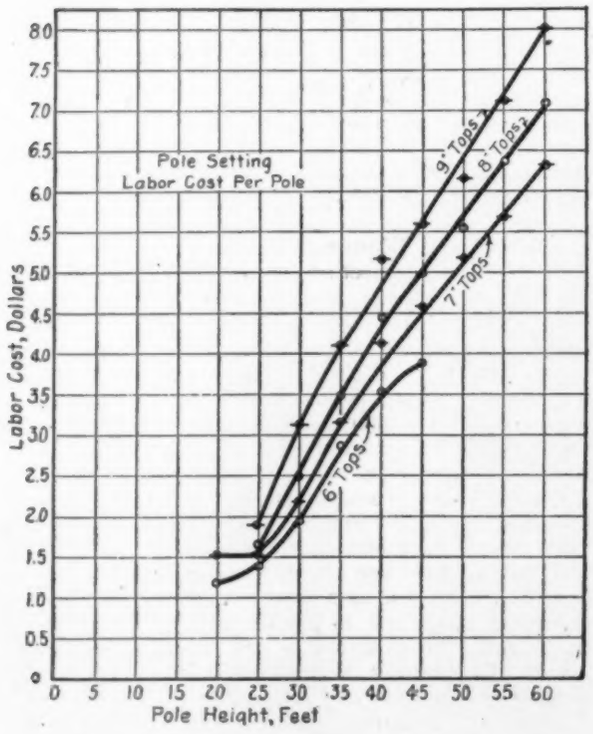


Fig. 3.—Labor Cost of Pole Setting Per Pole.

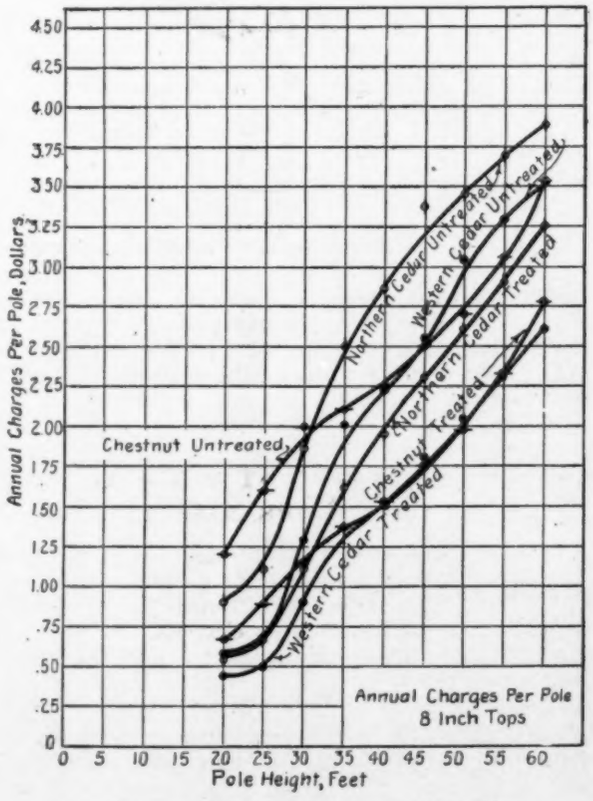


Fig. 4.—Annual Charges Per Pole, 8-Inch Tops.

OPEN-TANK TREATED.

Principal	$10.00
Cost treating	1.50
Interest at 7 per cent for 28 years	22.54
Total cost per pole for 28 years	$34.04
Cost per pole per year	1.22
Saving per pole per year	0.34
Saving per pole per year	22%

This method, however, is too general and does not consider all factors that enter into the investment. It does not consider freight charges nor labor costs incident to setting. These may be the same for treated and untreated poles, yet they should enter into the total cost because interest charges need to be paid on them. Then, again, no depreciation is figured. It would be necessary to put into a sinking fund a certain amount each year in order to replace the pole when it needed to be removed. Interest would be received on the sinking-fund deposit, and is not negligible. It is thought that by the method of figuring used in this article the saving arrived at is more accurate.

Taking this same case of a 7-inch top 35-foot northern cedar pole, in the calculations tabulated in Tables III and IV it is seen that the annual charges for an untreated pole amount to $2.025 and for a treated pole

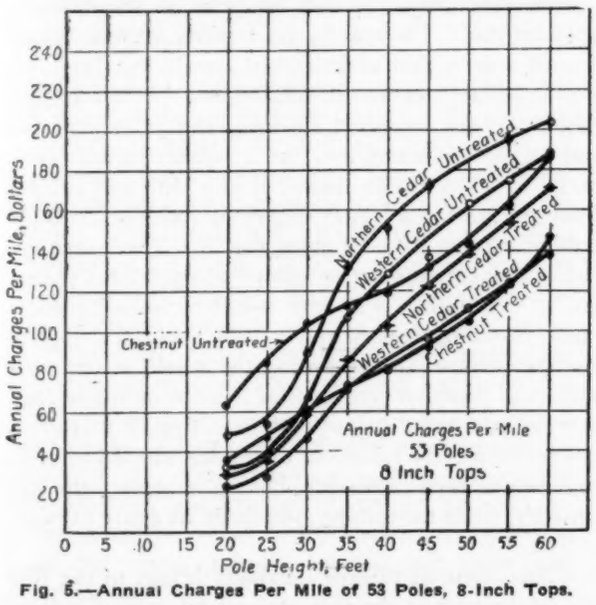


Fig. 5.—Annual Charges Per Mile of 53 Poles, 8-Inch Tops.

to $1.333, or a saving of $0.692 per pole in annual charges. This amounts to a saving of 33.8 per cent on the original annual charge, or 11.8 per cent greater saving than that computed by the company dealing in preservatives.

(To be continued.)

POWER GENERATED AT MINES TO SAVE NEW YORK COAL.

Fuel Administrator Garfield has authorized a survey to be made to determine the practicability of establishing central generating stations at anthracite mine centers and transmitting electrical energy to industrial centers at New York and other seaboard cities instead of transporting coal. If feasible, the project will be financed by the government.

It is planned to link up this system of transmission lines with all vital centers in addition to New York within a radius of 150 miles. Low grade coals will probably be used.

NEW YORK ELECTRICAL SOCIETY EXCEEDS MEMBERSHIP GOAL.

With only 105 new members to be secured and two months in which to do it in the intensive campaign being waged by the New York Electrical Society, the 500 mark set by the Membership Committee as its objective will be greatly exceeded. Although June 1 was the time specified for the culmination of the drive, it is now expected that the required number will be obtained long before that time. The success of the effort thus far makes the campaign slogan, "Over the Top by June 1," appear very modest.

The Membership Committee held a special meeting on March 27, attended by the main committee and the seven sub-committees, which made it possible to formulate plans for the final weeks of the drive.

So great was the enthusiasm manifested at the meeting that one of the sub-committee's chairmen volunteered to obtain a certain percentage of the remaining 105 members. Immediately every chairman made similar declarations and as a consequence, the entire number and more was pledged before the meeting adjourned. The branches of the electrical industry to be thoroughly combed for members include manufacturers, contractors and supplies, telephone and telegraph, electrified steam railroads, street railroads, holding companies and central stations.

The secretary of the Society, George H. Guy, is arranging for the next regular monthly meeting. It is intended to have some notable speakers present who will equal if not surpass those who have appeared.

POWER FOR MIAMI PROJECT.

The ELECTRICAL REVIEW of February 16 contained an article on the Miami Conservancy Project, Dayton, Ohio, in which the following sentence appeared: "It is understood the electrical energy will be supplied by the Dayton Power & Light Company at ½ to 2 cents per kilowatt-hour," which contained a typographical error. It should have read: "1½ to 2 cents per kilowatt-hour." Also, in stating that "current will be delivered at 6600 volts to a transformer at each of the five centers of operation," it is evident the writer was misinformed as to the facts, as we are advised that the company plans supplying energy direct from its new Miller's Ford power station over transmission lines at 3300 volts to various substations established by the district.

New York Illuminating Engineers Meet.—On April 11 a joint meeting of the New York Section of the Illuminating Engineering Society and the Metropolitan Section of the Society of Automotive Engineers was held at the Electrical Testing Laboratories, New York City. A feature of the program was the presentation of an illustrated paper by A. Bergman, of the Ordnance Engineering Corporation, on the subject "Rockets and Illuminating Shells as Used in the Present War." It described the construction and operation of rockets and the many types of illuminating shells for rifles, trench mortars and naval guns, which have been introduced during the present war. Also their use in revealing enemy movements and their novel use as a light barrage. An illustrated report of road test of headlighting conditions was made under the auspices of the Committee on Automobile Headlighting Specifications of the Illuminating Engineering Society and the Lighting Division of the Standards Committee of the Society of Automotive Engineers.

Editorial Comment

Trend of Turbogenerator Development

REFINEMENTS and growth in size of turbines have gone on steadily, each year has seen some advance, often a big stride in turbine design. Boilers, too, have improved, but less conspicuously and radically than the turbine. If the history of the turbogenerator is considered as having commenced in 1889 when Parsons built his first 75-kilowatt turbine that ran at 4800 revolutions per minute, the history of turbine development is a brief but marvelous one. In less than 30 years the turbine has come to replace almost entirely other forms of steam-driven prime movers. From a unit of a few kilowatts the turbogenerator today reaches 60,000 kilowatts and even 75,000-kilowatt units are on order. Units of 10,000 kilowatts are so common now as to pass unnoticed, 20,000-kilowatt machines are quite ordinary, 35,000-kilowatt units are looked upon as a matter of course, while machines of 50,000 kilowatts still arouse interest. It might be mentioned in passing that it is the central-station industry, centralized bulk electrical energy generation that has made the development of the turbogenerator possible on the scale attained today. It is the turbogenerator in turn that has made possible the concentration of enormous amounts of energy within relatively small space. Moreover, it is the steam turbine that has made possible the conservation of fuel, the low rates for energy and high degree of continuity of service that obtain today.

Turbogenerators like the one described in this issue, of 35,000 kilowatts and over, operating at 230 pounds pressure and a superheat of 200 degrees Fahrenheit and 29 inches of vacuum, are capable of generating a kilowatt-hour on 10.75 pounds of steam at their most economical rating, showing an efficiency ratio of 75.4 per cent. With turbines operating at such efficiencies as these, delivering 76 to 80 per cent of the theoretical energy available from steam expanding between the limits now in vogue—250 to 200 pounds steam pressure, 200 degrees superheat, to 29 inches vacuum—it is a reasonable question to ask along what lines is turbine development trending. The wisdom of extending the present limits has already been widely discussed, namely, increasing the pressure of the steam by going to 600 pounds pressure at 128 degrees superheat and 29 inches of vacuum. Such a practice would, it is true, increase the theoretical available energy some 13 per cent or so, but of this amount perhaps not more than half the theoretical would be utilized by the turbine. On the other hand, the cost of the turbine and difficulties of design would be considerably increased, boiler efficiencies will go down, stack temperatures will become such that economizers will be necessary.

At present, while considering the advisability of increasing steam pressures, which may bring with it many troubles about which there is rather limited knowledge, turbine development is following along somewhat different lines. Efficiency has and is receiving considerable attention, a little refinement here and there rather than radical changes. But the trend of development seems to be more toward increasing reliability and convenience of operation. Thus the tendency of turbine design is to increase the cost of a unit rather than reduce it. Higher steam temperatures and pressures make for more generous design, more expensive workmanship and materials, greater factors of safety against known and unforeseen conditions. Greater reliability, too, adds its quota to the increase in initial cost. The only factor tending toward reduction of cost is that of increased speeds, but this, for any frequency, leaves but little choice. While higher initial cost for increased efficiency can be capitalized, and the determination how far it is commercially beneficial to go is readily made, it is a different matter when paying for a higher degree of reliability. Standards of service are ever going higher. The larger the size of unit employed the greater the dependence placed on it. And then with the tendency to sectionalize units, installing boilers and auxiliaries each complete for the turbine, and operating the whole as one separate and complete unit, makes it more desirable than ever to have reliability of turbine design, for whereas one boiler may be taken out of service and the remaining ones worked sufficiently harder to replace the lost capacity, when the turbine goes down its entire capacity is lost.

This phase of turbine reliability brings to the fore the advantages of the cross-compound type of turbine for very large units. By connecting the various turbine stages or cylinders in series, as it were, each with its own generator, which are likewise connected together, any section may be taken out of service without placing hors de combat the remaining sections, an arrangement that adds very much to the reliability and flexibility of the turbogenerator unit as a whole. There are other advantages of the cross-compound type of turbine in that segregation of the various elements permits of utilizing well-proven design, and thus is lessened the likelihood of encountering unexpected and unforeseen difficulties in the way of thermal and mechanical stresses, which also extend limitations of generator design. There are, of course, disadvantages of the cross-compound arrangement, of which the more prominent are the larger floor space occupied and the higher cost per unit of capacity.

Steam turbines today are available in sizes from a

hundred kilowatts or so up to capacities of 60,000 and 75,000 kilowatts. These units may be obtained with a single turbine and generator, tandem-compound turbines with single generator, and cross-compound turbines of two and three turbines, each driving its own generator and occupying a floor space of less than one-half square foot per kilowatt capacity. These enormous machines are operating at an efficiency ratio of 76 to 80 per cent, and with a steam consumption around 10.65 pounds per kilowatt-hour. But, however pleasing is the increasing efficiency, reliability and economy of the large turbogenerator, it is nevertheless almost disheartening to know that notwithstanding the expenditure of so much brilliant engineering skill, so much expense and expert workmanship toward gaining a fraction of 1 per cent increased efficiency, some 50 per cent of the heat evolved by the coal still goes away to heat the rivers of our cities, or other source of condenser supply as wasted heat.

Grounding of Fixture and Appliance Casings

OF CASES of serious or even fatal electric shock that have occasionally occurred in the premises of the ordinary user of electric light and power, probably the most numerous have been caused by the metal casings of lighting fixtures or portable appliances becoming "live" through failure of the insulation in the fixture or appliance. If this occurs where there are no grounded surfaces, such as plumbing fixtures, steam or hot-water radiators, in the vicinity, no serious consequences may follow touching the live casing; but in the presence of damp floors or other well grounded surfaces touching the live casing is likely to produce a violent shock. Fortunately, the number of serious accidents from this cause, as from other causes of electric shock, has been small indeed in comparison with the very large number of electrical installations, but it is enough that fatalities have occurred that could have been prevented.

This matter has been given a great deal of study by all interested in promoting still greater electrical safety and notably by the Bureau of Standards, which gave the subject most careful consideration when it drafted the National Electrical Safety Code. In Sections 36 and 37 of this Code, which we reproduce on other pages of this issue, the solutions of this problem are presented in very clear language.

In the case ot fixtures, from the safety standpoint, these should be placed wherever possible on the ceiling or other places where they will be out of reach, wall switches or pendent switches giving the necessary control. Where this is impossible the fixture should preferably be located so that contact between it and a well grounded surface can not readily be made. In many instances, however, the fixtures must be located near to plumbing or other grounded surfaces. In such cases only two solutions are available. One is to use an insulating casing for the fixture, or at least for the sockets which are the weakest parts of it; porcelain and composition sockets are available in a great variety of types for this purpose. The other solution is to thoroughly ground the metal casing of the fixture. This is best done by a good connection to the water piping whose proximity has usually caused the special hazard. In certain cases grounding is not advisable; these are reviewed in the discussion of Rule 360 of the Safety Code.

Lighting circuits are most commonly connected to three-wire, grounded-neutral, distributing feeders. It is readily possible to identify the neutral or grounded side of two-wire branches from such feeders; this has been done for many years at Providence, R. I., and the recently revised Rule 26*a* of the National Electrical Code provides that after January 1, 1919, the neutral wire on all three-wire grounded circuits and one wire of all two-wire branches therefrom shall have an identifying insulating covering. This identified conductor must be connected to the neutral or grounded side of the system throughout the installation. The advantage of this arrangement is that it permits connecting the screw shells of all sockets and receptacles to the grounded side of the circuit and the central contacts to the ungrounded side, thus making it much more unlikely that the outer shells or casings of sockets or fixtures will become "live." This is a valuable safety feature and it is to be hoped that it will be carried out in all new wiring and rewiring work.

Portable lighting fixtures and other appliances present a much more difficult problem. In many cases they practically must have metal casings, which it is obviously very difficult to ground securely. The heavy wear and tear on a portable device that is handled a great deal means very severe strain on the insulation between its live parts and casing, which is the only protection against shock that is afforded the user. To safeguard such devices this insulation should be exceptionally strong and durable. As an additional protection the metal parts of the casing should be grounded, because the need for this is even greater than in the case of stationary fixtures. Rule 371 of the Safety Code recommends such grounding, especially for devices likely to be used near damp or other grounded surfaces, and for devices used on circuits of more than 150 volts.

Such grounding, of course, can be carried out by means of a separate ground wire forming either a part of or entirely distinct from the connecting cord. In the former case this means a three-wire cord with the ground wire carefully identified and connected to a special or polarized ground terminal on the attachment plug and receptacle. Such cords are practically not available at present. By use of the identified conductor called for by the new Rule 26*a* of the National Electrical Code it will be possible to secure ground connection to the neutral, grounded side of the system without the additional expense and trouble involved in a separate, third conductor in the cord.

Week's Events

Minneapolis Contractors Endorse Goodwin Plan—1917 Electrical Exports—Chicago N. E. L. A. Meets—Other News

N. E. L. A. TO MEET AT ATLANTIC CITY JUNE 13-14.

Annual Meeting to Be Devoted Entirely to Discussion of War Problems.

The annual meeting of the National Electric Light Association will be held at the Hotel Traymore, Atlantic City, N. J., on June 13 and 14. This action was decided on at a meeting of the convention committee on April 3 in New York, and the official call for the meeting has been made by President Lieb.

It was previously decided that the meeting should be held at some point in the middle west but after further discussion Atlantic City was selected.

In commenting on the purpose of the meeting Secretary Martin says, "While it is felt that it is necessary under the constitution to hold our annual meeting, the essential requirement is the limitation of work in the meeting to the consideration of pressing and vital war problems as related to the industry. In view of the fact, however, that practically all our member companies are short handed and that their officers have their time taken up not only with general problems of the industry but with local problems and difficulties that come upon them as patriotic citizens, it is believed that the attendance at the meeting will inevitably be much smaller and more restricted than would occur in normal times and under the usual conditions; all other subjects however important being swallowed up for the time being in the fundamentally vital and essential one of winning the war."

The personnel of the convention committee is as follows: W. Neumuller, New York City, chairman; T. C. Martin, New York City, secretary; H. C. Abell, New York City, J. L. Bailey, Baltimore, R. H. Ballard, Los Angeles, M. R. Bump, New York City, J. E. Davidson, Omaha, Leavitt Edgar, Boston, E. A. Edkins, Chicago, Dudley Farrand, Newark, Martin Insull, Chicago, W. H. Johnson, Philadelphia, A. W. Leonard, Seattle, Robert Lindsay, Cleveland, S. J. Lisberger, San Francisco, R. J. McClelland, New York City, E. S. Mansfield, Boston, C. S. Ruffner, St. Louis, Frank W. Smith, New York City, S. B. Way, Milwaukee, W. F. Wells, Brooklyn.

At a recent meeting of the executive committee of the National Electric Light Association, it was decided that a committee of three members should be appointed to co-operate with similar committees of the electric railway and gas industries in the formation of a conference or joint committee to advise in regard to such utility problems of national interest as may be specifically assigned for consideration. This suggestion arises from the desire to give specific direction and authority to the work which is being done now by the National Committee on Public Utility Conditions, representing the N. E. L. A., American Electric Railway Association, American Gas Institute and National Commercial Gas Association.

President J. W. Lieb presided at the meeting.

MINNEAPOLIS CONTRACTORS ENDORSE GOODWIN PLAN.

Important Meeting Held in Minneapolis, April 5 and 6, Attended by All Electrical Interests.

A meeting of electrical contractors, dealers, central-station men and others interested in the electrical industry of Minnesota for promoting the Goodwin Plan was held in Minneapolis on April 5 and 6 and proved very successful. A dinner took place on Friday evening, April 5, with about 200 in attendance. At this gathering Dean John R. Allen of the University of Minnesota gave a very interesting talk on electrical conditions in continental Europe, in the course of which he stated that in investigating these conditions four years ago he found that most of the countries were from 10 to 15 years behind the United States. He told of his early experiences and cited as instances the wiring of what is now known as the Stratford Hotel in Chicago with annunciator wire and the wiring of the Marquette building with brass armored conduit. Considerable time was devoted to a discussion of the Goodwin Plan and a talk by Mr. Goodwin was enthusiastically received. Mr. Goodwin dwelt at length on the policy of some manufacturers, central stations and dealers to spend more money selling the electrical idea in place of their individual appliances. He stated several manufacturers advertise similar articles and each tells of the superiority of his article over that of his competitor, with the result that the customer becomes confused and does not know from whom to purchase. It was suggested by Mr. Goodwin that if all would advertise the idea of using electrical appliances, a greater desire would be created and each manufacturer in turn would receive his proportionate share of the business and increase sales.

A meeting was held on Saturday, April 6, and was attended by 50 contractors and dealers from all parts of the state. At this session the new constitution and by-laws was ratified and the executive committee authorized to hire a paid secretary.

ELECTRICAL EXPORTS FOR YEAR 1917 BREAK ALL RECORDS.

December Figures Close to Highest Month—January Figures Near Average Monthly Amount.

Interesting facts respecting electrical exports are disclosed in the December and January monthly summaries of the foreign commerce of the United States, which have recently been published by the Bureau of Foreign and Domestic Commerce, Washington, D. C. Electrical shipments for last December exceeded those of the corresponding month in 1916 by nearly 21 per cent, and came within $110,000 (or about 1.9 per cent) of the highest monthly total yet attained—that of June, 1917. The January figures fell below those

of December by a considerable amount, in fact, even below the figures for January, 1917, and yet they are slightly above the average monthly total for the calendar year 1917.

In the following table are shown the detailed classified figures for electrical exports in last December and January, each month being compared with the corresponding period of a year ago. These figures are listed in the government reports as covering electrical machinery and appliances, except locomotives; it is believed they cover substantially all distinctively electrical exports, except locomotives specifically mentioned. However, considerable electrical equipment is exported that can not be included in electrical exports because it forms a minor part of other machinery, etc.; an example of this is the electric starting, lighting and ignition equipment shipped as part of complete automobiles of the gasoline type.

Articles.	December 1917.	December 1916.	January 1918.	January 1917.
Batteries	$ 370,486	$ 212,457	$ 295,520	$ 379,781
Carbons*	178,567	.....	93,543	.....
Dynamos or generators	138,450	305,759	252,429	271,742
Fans	73,106	23,422	68,541	43,660
Heating and cooking apparatus*	58,701	.....	59,652	.....
Insulated wire and cables	676,651	630,732	548,931	808,579
Interior wiring supplies, including fixtures	134,398	110,750	104,710	133,140
Lamps—				
Arc	1,534	1,146	671	973
Carbon-filament	27,172	16,297	9,567	15,470
Metal-filament	341,086	128,394	200,420	181,785
Magnetos, spark plugs, etc.*	328,527	.....	380,098	.....
Meters and measuring instruments	191,539	102,832	124,192	94,575
Motors	730,585	526,952	555,842	659,620
Rheostats and controllers*	21,641	.....	13,007	.....
Switches and accessories*	221,022	.....	271,196	.....
Telegraph apparatus, including wireless	44,644	15,654	9,208	24,808
Telephones	278,162	301,107	249,992	132,807
Transformers	213,243	86,370	174,001	133,539
All other	1,696,862	2,284,965	1,245,091	2,032,445
Total	$5,726,376	$4,746,837	$4,656,611	$4,912,924

*Not separately listed prior to July 1, 1917.

The following table shows how the electrical exports fluctuated from month to month during 1917:

Months. 1917.	Electrical exports.
January	$4,912,924
February	3,526,269
March	5,199,163
April	4,740,995
May	4,588,711
June	5,837,056
July	3,827,345
August	3,607,278
September	4,190,110
October	4,151,635
November	5,374,117
December	5,726,376

In the following table is given a detailed comparison of the last two calendar years. This shows that 1917 exceeded 1916 by nearly 38 per cent. In fact, the total value of electrical shipments in 1917 was greater by over 6 per cent than any preceding twelvemonth, the fiscal year July, 1916-June, 1917, being the next largest. Other recent calendar years compare as follows: 1914, $19,963,115; 1915, $24,341,588.

Articles.	1917.	1916.
Batteries	$ 3,624,222	$ 2,025,250
Carbons*	736,717	.....
Dynamos or generators	2,356,780	1,867,565
Fans	622,731	313,771
Heating and cooking apparatus*	256,533	.....
Insulated wire and cables	7,187,951	4,943,577
Interior wiring supplies, including fixtures	1,405,772	901,657
Lamps—		
Arc	16,418	15,467
Carbon-filament	187,876	124,776
Metal-filament	2,884,675	1,420,309
Magnetos, spark plugs, etc.*	1,757,848	.....
Meters and measuring instruments	1,213,278	884,241
Motors	6,484,972	4,932,831
Rheostats and controllers*	93,612	.....
Switches and accessories*	1,025,003	.....
Telegraph apparatus, including wireless	555,703	209,343
Telephones	2,212,237	1,813,969
Transformers	1,747,884	1,051,168
All other	21,107,867	19,740,151
Total	$55,478,079	$40,244,075

*Figures cover six months beginning July 1, 1917, only.

CHICAGO SECTION OF N. E. L. A. HOLDS SUCCESSFUL MEETING.

Associate Editor of the Electrical Review Wins First Prize for Most Meritorious Suggestion.

The Commonwealth Edison section of the National Electric Light Association held a very successful meeting in the Customers' Hall, Edison building, on Tuesday, April 2. Major Bernard Flexner, a distinguished member of the commission to Roumania, gave an interesting and instructive address on the situation in war-stricken Roumania, and by the use of maps, both geographical and ethnographical, gave a clear idea of political and racial difficulties with regard to the boundaries of Roumania and her location with respect to the Austro-Hungarian drive for the Black Sea. He described the country through which the commission traveled on its long route from Vladivostok through Siberia to Roumania, giving his impressions and experiences while helping to reduce the ravages of pelagra and the scourge of pneumonia and typhus. During the evening the Edison Symphony Orchestra provided a most agreeable program.

Preceding Major Flexner's address, the award of prizes for suggestions for the six months' period, ending December 31, took place. The award of prizes was as follows:

First prize, $50—I. L. Kentish-Rankin.
Second prize, $40—J. W. Cleaveland.
Third prize, $30—H. E. Denzin.
Fourth prize, $20—Marcus Calder.
Fifth prize, $10—H. E. Denzin.

Mr. I. L. Kentish-Rankin, formerly with the testing department of the Edison Company and now associate editor of the ELECTRICAL REVIEW, was awarded the first prize for his suggestion covering discriminating test methods for live and dead circuits and a method for identifying phases of live 4000-volt circuits.

This is the second time Mr. Kentish-Rankin has been the recipient of the first prize awarded by Samuel Insull for the most meritorious recommendation, he having also received it in 1915. He is understood to be the only one to whom this prize has twice been awarded.

WAR COURSE FOR ELECTRICIANS AND TELEPHONE MEN.

A war training course for electricians and telephone men needed for the United States Army has just been published by the Federal Board for Vocational Education. This course, it is planned, will be given to drafted men, enlisted and detailed on subsistence and pay to schools co-operating with the Federal Government in the preparation of mechanics and technicians for military service. The course consists of 36 lectures and four class room, field and shop units on electric wiring, testing, motors and generators and telephone work. The instruction book is known as Bulletin No. 9 and may be secured free upon application to the Federal Board for Vocational Education, Ouray building, Washington, D. C.

Commercial

Appliance Selling Methods—Electricity Saves Coal Burned at the Mines—Rockford Company Active in Range Sales

CUSTOMERS ENCOURAGED TO EXAMINE AND HANDLE APPLIANCES.

Ideas and details of merchandising are being successfully put in effect at the electrical appliance store of Public Service Company at Waukegan, Ill. Theodore Blech, division superintendent at this branch, estimates that 7000 to 10,000 persons per month call at this store and office. Their mission is to pay light bills, to visit the appliance department, and on other business. To take full advantage of this sales opportunity, the office force was entirely segregated from the store proper, although persons coming in to pay light bills pass through the store. Mr. Blech not only keeps up alternating window displays and table displays, but arranges to have appliances ready for immediate demonstration. Lamps are turned on, toasters are given the live wire, and a vacuum cleaner is connected up and set upon a rug for trial. He believes in letting the customer try these utilities, and wishes to get away from the old "touch-not" idea with signs to keep off grass.

When a patron is liquidating a light bill, the tactful cashier calls attention to some specialty being pushed. In the sale of electric irons, attention may be called to the large number bought by the sailor boys at Great Lakes training station.

In support of the theory that a salesman needs initiative and adaptability, Mr. Blech differentiates between a sales clerk and a salesman, and the ambition of the salesman is stimulated by a good salary plus a commission.

At Waukegan, as in other divisions in public service operations, sales courses have been started to develop the salesmanship ability of employes and post them on all the appliances. In the sale of washers, wringers, vacuum cleaners, ironers and ranges at this store, 95 per cent are on time payments, and in dealing with this trade, made up largely of wage earners, a liberal policy is adopted.

ELECTRICITY TO SAVE COAL BURNED AT MINES.

Millions of tons of coal, now necessarily consumed in the mining operations, would become available for general commercial uses should electricity be substituted for steam in operating the collieries of the United States. Earnest studies are now being made by experts in Washington and elsewhere to determine what can be done, and quickly, to expand electric power developments throughout the country, not only, nor even primarily in connection with coal production, but also and mainly to meet the urgent requirements of war and other industries.

The anthracite industry is now consuming in its operations about 8,800,000 tons of the coal mined and prepared. Using steam there is no way to reduce this. It is estimated that with the entire industry turned over from steam to electricity, for power, light and heat, that about 6,000,000 tons of such mine-consumed coal would be saved and be available to supply public demands.

Already substantial progress has been made in substituting electricity for steam in the anthracite operations. Latest complete figures show at the beginning of 1916, 80,000 kilowatts of electric power installed for this use. This has been substantially increased since then, but there is yet a long way to go before current can be employed throughout and for all purposes.

Many anthracite companies have installed individual electric power plants to serve their own needs. It is an economic proposition, but the war demands upon electric manufacturing concerns have been so urgent that it is now virtually impossible to get additional machinery. Also it has been conclusively demonstrated, both in theory and in practice, by such leaders in electrical development as Samuel Insull of Chicago and S. Z. Mitchell of New York, that the central power plant makes the best and lowest cost system of supplying current.

METHODS OF SELLING APPLIANCES ON THE INSTALLMENT PLAN.

A middle western central-station company that conducts a large electrical appliance department, outlined to a representative of the ELECTRICAL REVIEW some phases of its methods of merchandising. The methods are not new, but the fact that they are successful may make them beneficial to those whose merchandizing plans are not fully developed. The concern referred to sells an average of 100 vacuum cleaners and 50 washing machines per month, and in the last two years has sold 600 electric stoves and ranges in its field of operations. About 75 per cent of its sales are made on the installment plan. In selling washers, cleaners and ranges the practice is to require a cash payment of 25 per cent, and take a contract in the usual form for the other payments in 12 monthly installments. Practically all sales originate in the large store to which place the light customers come to pay their bills. This opportunity of getting the customer's attention is aided by displays of the appliances in groups about the store. The washing machines, cleaners and ranges occupy separate floor spaces; and the smaller appliances, such as flat irons, curling irons, toasters and lamp globes, are similarly displayed on separate tables, counters and in windows.

No salesmen are sent out to call at residences, and the practice of using the telephone to induce trade is not considered advisable. No machines are sent to possible customers on approval, or on trail. However, a demonstration of every machine is made at the customer's home at the time of delivery, or as soon thereafter as may suit the buyer's convenience. The demonstrator not only instructs the customer in the use of the machine, but makes sure that there may be no mechanical defects that need attention. The demonstrator's work is of the greatest importance after a

sale is made, as he is also a troubleman who answers calls promptly when complaints are made. Such appliances as flat irons are sold on the installment plan, also, but usually the time of completing payments extends no longer than three or four months. The fact that most appliance buyers are light customers enables a concern to list the installment payments on the light bills. Accounting costs for sales on installments are thus kept at a minimum.

When asked about manufacturers' guaranties of machines, the manager of the appliance sales department said special efforts were made to sell machines on their demonstrated merits, and salesmen were required to fully explain to the purchaser that the guaranty covered imperfections and mechanical defects, but not repairs due to natural wear. However, a liberal policy was pursued with respect to repairs of a minor character for which often no charge was made.

In the lamp department a renewal feature consists of placing an allowance value on old lamps replaced by new ones.

The credit system, based on installment payments, is a well-established feature of this concern's business; and it works out satisfactorily and advantageously to company and its customers.

ROCKFORD COMPANY ACTIVE IN ELECTRIC-RANGE SALES.

Over 75 Installations Now Operating—Newspaper Advertising Big Feature in Sales—Records of Performance Kept.

Electric cooking is making rapid strides in Rockford, Ill., there already being over 75 installations. The war-time arguments in favor of electric ranges, namely, that they conserve fuel, food and labor, are being utilized to the fullest extent and by means of a newspaper advertising campaign, followed by personal calls, every customer of the Rockford Electric Company is being impressed with the advantages of electric cooking.

In selling the electric, the company requires an initial payment of half cash, the balance being divided into six to 12 monthly payments. The utility does no wiring, or installing. The purchaser engages his own contractor for this work. No sales are made, however, off the company's own lines. In following up new residence construction the company's salesmen interview the owners and urge the advisability of putting in conduits of sufficient size to carry the wires required, not only for light, but for electric range service. When a range is sold the charge is made on the basis of a combination rate for the light and range, which are on the same meter. This rate amounts to about three cents per kilowatt-hour. It is stated that the average of light and range bills for 60 homes has been running $5.92 per month.

One of the essentials in connection with each sale is the work of the lady demonstrator. She not only explains and demonstrates the use of the electric range in the company's sales room, but makes a demonstration at the purchaser's home. She is also a saleswoman and by pre-arrangement she calls at the homes of prospective customers to explain the advantages of cooking by electricity.

For the purpose of interesting people in the electric range the company depends to a great extent on newspaper advertising, using large spaces in local papers. Herewith are reproduced two of its recent range advertisements.

Byllesby Utilities Devote Advertising Space to Liberty Loan Committees.—Advertising space in several hundred newspapers throughout the country will be donated by Byllesby utility properties to advertising the third Liberty loan. Each manager will cooperate with the local Liberty Loan committee in the most effective manner.

A Dream Realized!
Particularly from the standpoint of comfort, convenience and cleanliness in the kitchen equipment, has the present day housewife much to be thankful for.
From the time of open fireplaces down through the more recent days of modern appliances, cooking has been WORK—attended by inconvenience, uncertainty, uncleanliness, waste, risk.
But now cookery is being revolutionized by the ELECTRIC RANGE. The unpleasant and disappointing condition of the past are supplanted by comfort, cleanliness and convenience. You can do any kind of cooking with the Electric Range.
Safe
Sanitary
Saves Time
Saves Heat
Sure in Results
Simple to Operate
Saves Food
Rockford Electric Company

HERE IT IS—
A reproduction of the Electric Range that everyone is talking about—
Can You Imagine How Clean Everything Would Be If You Cooked Electrically? No Soot to Accumulate on Pots and Pans No Time Wasted in Scouring
G-E Type S-3 Electric Range
You Will Never Believe That There Could Be Such a Difference in the Taste of Your Cooking Until You Try the Electric Way. It's Delicious.
The Above Stove is now selling for $65.00
Only $20.00 necessary with order; balance 12 payments. After present stock is gone, NEW PRICE will be about $80.00. Order now! Only 10 Stoves left at low price. Phone Main 370.
Rockford Electric Company

Two Newspaper Advertisements of the Rockford Electric Company Pointing Out Advantages of Electric Cooking.

Operating

Static Condensers — Flexible Furnace Voltage Control — Modifying Centrifugal Pumps—Pole Transformer Mounting

STATIC CONDENSER IMPROVES POWER FACTOR.

Installation at Industrial Plant Reduces Current 27 Per Cent and Raises Power-Factor 37 Per Cent.

By Arthur Bridgeman.

Operating engineers have been too busy of late striving to save coal and carry overloads to talk much about power-factor. However, at this time when every piece of apparatus such as generator, transformer and even tranmission conductors needs to be used to best advantage never was it more imperative than now to obtain high power-factor instead of allowing low power-factor to overload exciters, heat up generators and transformers and interfere with voltage regulation.

Considerable information is available as to the use of synchronous motors for power factor correction, both with and without mechanical load, automatically controlled or otherwise, and to what extent it pays to raise the power-factor. There are many instances, however, where it is not feasible to employ the comparatively expensive synchronous equipment and necessarily somewhat skilled labor, although power-factor correction is urgently required. In these cases the static condenser must eventually come into increased used. European engineers have already developed the static condenser for power-factor correction and placed it upon a commercial basis. While this country has not adopted it to the same extent that has Europe, nevertheless, it is beginning to be recognized as a very simple and comparatively inexpensive piece of equipment as to initial and upkeep costs, that accomplishes an important function.

In one industrial plant purchasing central-station service a low power-factor was responsible for poor voltage regulation and waste of transformer capacity, and prevented increase of load being made unless either the power-factor was raised or additional transformer capacity installed. As the overloading of valuable equipment by wattless current was recognized as objectionable, and as equipment had to be conserved for useful purpose, it was decided to bring the watt and wattless currents or actual and apparent components of energy, closer together by improving the power factor. As the installation consisted of transformers, isolated and without attendance, it was decided that static oil-immersed condensers would be suitable, since all they needed was floor space and protection against moisture, and when once installed, needed no further thought.

Before these condensers were installed the characteristics of the circuit were found to be as follows:

Volts.	Amperes.	Kilovolt-amperes.	Kilowatts.	Per cent power-factor.
2010	40	80.4	56	70

After installing the static condenser, and with the same load the characteristics of the circuit were found to be thus:

Volts.	Amperes.	Kilovolt-amperes.	Kilowatts.	Per cent power-factor.
2010	29	58.2	56	96

It can be seen that the power-factor was increased or raised some 37 per cent, and by so doing resulted in current decrease of 27 per cent.

The synchronous motor, used to carry mechanical load and correct power-factor, has its place—where there is attendance capable of taking care of both power-factor and apparatus. There are many more cases where attendance is out of the question, and it is in such as these cases, industrial transformer stations, mine supply and installations remote from skilled labor, that the static condenser could be used to good advantage now. Moreover, were installations originally laid out for use with a static condenser, even greater benefits could be derived, since conductor cross-section, transformer capacity and even rates could be modified accordingly.

MAINTAINING RELAYS.

By Cecil Norris.

While it is always important to keep overload relays in repair and in working order so that they will operate without fail and closely to calibration, it is particularly necessary to pay attention to this matter at this time when apparatus is heavily and often overloaded. A short circuit is likely to have more serious effect upon a system already fully loaded than one lightly loaded. Moreover, with so many men having gone into the National Army and elsewhere, the shortage of labor tends to allow this matter to be left in abeyance. It is, however, poor policy.

All relays should be checked up to test their calibration not less than every six months. Working parts should be cleaned, air valves overhauled, leather bellows oiled if dry, and all moving parts operated to assure their working.

Glass and other forms of covers should be examined, and if dirt and dust are able to enter to the relay, felt should be employed to make the covers as air and dirt-tight as possible. A little attention given to relays periodically is time well spent.

CHANGING FURNACE VOLTAGE BY VARIABLE TRANSFORMER CONNECTION.

Connecting Transformer Delta or Star Permits of Flexible Operation.

The rather clumsy methods of hand control of voltage and electrode spacing at first in vogue with electric furnaces are giving place to more flexible, more efficient methods, largely automatic. The result is reduction in the time of melt, lower energy consumption, and usually improved power-factor, and last

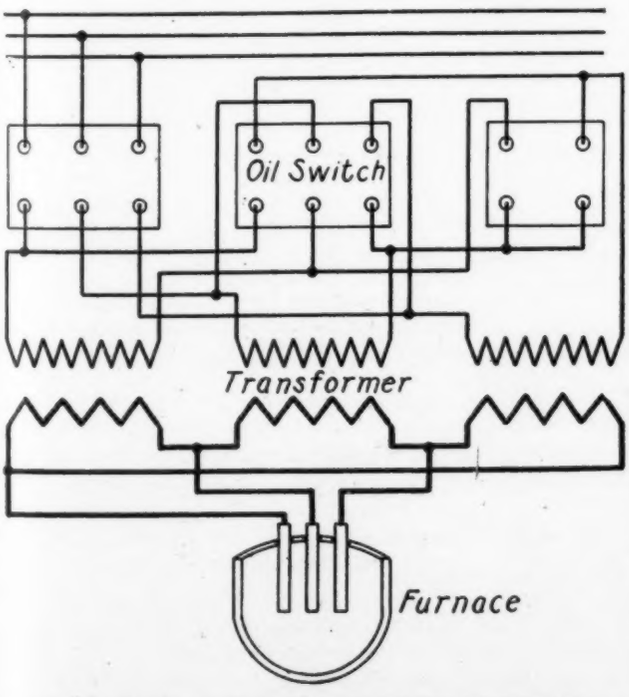
but not least, lesser labor costs. One way of speeding up the time of melt is to change the voltage at the electrodes, as pointed out on page 611 of the April 6 issue of the ELECTRICAL REVIEW.

It is becoming increasingly common to employ higher voltage during melting down, reverting to the usual voltage of about 100 volts for refining.

The diagram shows a method by which the transformer supplying the furnace may be connected either delta or star, in this way changing the voltage between the electrodes of a three-phase furnace in the ratio of 1 to 1.732, or, say, from 100 to 173. It will be seen that there are three oil switches. The switch on the left-hand side is the main control switch in the high voltage side of the transformer serving the furnace and must be installed irrespective of the transformer connection employed. The two other oil switches, one a three-pole, the other a two-pole breaker, are used for changing the transformer connections, and their cost is rightly chargeable to the method of varying the voltage.

With the center circuit breaker closed, the right-hand switch should be open, the transformer or transformers are connected delta on the high-voltage side. With the right-hand breaker closed and the center breaker open, the transformer windings are connected in Y or star.

In the ordinary course of events the left-hand breaker would be controlled by a current transformer and overload relay for interrupting the energy in case of excessive load. The remaining breakers should, however, be hand controlled and non-automatic. Moreover, it might be best that they be mechanically interlocked so that both cannot be closed together, or the one closed while the other is already closed. Should either of these be done, a short-circuit will occur. Again, the main controlling oil switch should have rupturing capacity for the load at operating voltage. The two change-over switches, on the other hand, may have smaller capacity since they should not be called upon to interrupt the load, but merely change over whilst the main switch is open, and thus capacity may be chosen according to heating. Whether the two change-over breakers are of the oil immersed type or not depends upon the primary voltage of the transformers, and for the lower supply voltages, say up to 12,000 volts, it might be quite satisfactory to use disconnects instead of oil switches.



Use of Delta and Star Connections for Varying Electrode Voltage of Three-phase Electric Furnace.

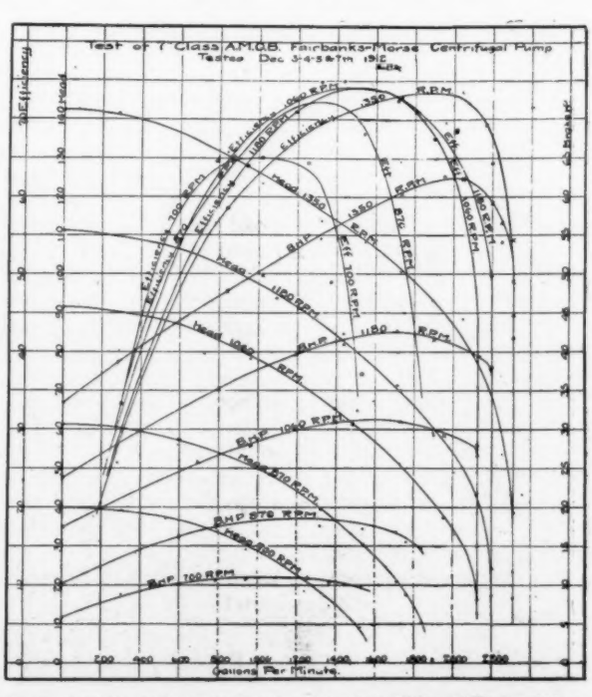
MODIFYING CENTRIFUGAL PUMP FOR DIRECT MOTOR CONNECTION.

Limitations of Induction Motor Speeds May Necessitate Changing Pump Characteristics.

BY B. B. JACKSON.

The selection of a standard centrifugal pump from a manufacturer's line of pumps for direct connection to an induction motor may present quite a problem in the way of obtaining the correct speed, such as is not encountered where belt, chain or reduction gear drive is employed. For instance, with a 60-cycle induction motor the speeds are limited to 1750, 1150, 850, etc., revolutions per minute.

The discharge and efficiency of a centrifugal pump are intimately related to speed for a given head or lift, as will be seen by referring to the accompanying curves. If the output or capacity of the pump is to remain constant with increase or lift or head the speed must be increased. For example, suppose it is required to deliver 1400 gallons of water per minute under a 50-foot head by a pump whose characteristic curves are shown. These curves show that to obtain the required delivery under a head of 50 feet a speed of 960 r.p.m. is necessary. The motor speed nearest this is, however, 1150 r.p.m. But if the pump is driven at 1150 r.p.m. with a head of 50 feet the discharge is seen to be 2000 gallons per minute instead of 1400, and at an efficiency of 65 as against 70 per cent in the



Characteristics of 7-inch Medium Head Centrifugal Pump When Operated at Five Different Speeds.

latter case. It would, of course, be feasible to choose a pump one or two sizes smaller, if it were available, but doing so is open to the objection that a loss of efficiency occurs.

By means of a simple surgical operation of the centrifugal pump it is possible to adapt it to the conditions imposed, and without sacrificing efficiency of performance to serious extent. All that it is necessary to do consists of cutting down the diameter of the impeller vanes. This is a simple and inexpensive way of getting out of a difficulty, and often the only way when time is short. By following this practice manufacturers of centrifugal pumps are able to furnish standard units for direct connection to induction motors on short notice, are enabled to make quicker deliveries than had special pumps to be designed, also at a lower price. Moreover, by the above procedure, any desired combination of head and delivery is obtainable for a given speed.

SIMPLIFIED MOUNTING FOR POLE TYPE TRANSFORMER BANKS.

By W. H. Kuntz.

The proper support of transformers supplying the average power customer is a problem well worth considering. While transformers up to and including the sizes of 15kv-a may be suspended in banks of three, by hanger and cross-arms, transformers from 15kv-a to 100kv-a inclusive, when used in banks of three or, more, should be installed on a platform. When it is necessary to supply loads of over 300kv-a, double banks may be installed and operated, either separately or in parallel. The former case represents the better practice as it eliminates the bad features of parallel operation and encourages primary metering. In the opinion of the writer, the average installations of 500kv-a, or over, are best served from transmission lines and outdoor substations.

Fig. 1.—Mounting of Transformer Bank on Platform for Rapid Removal.

In the design of a transformer platform three features must be considered, namely, safety in operating, restoration of service in case of trouble, and cost of platform.

In order to be safe, the platform should be substantially constructed, and should have sufficient clearance around the transformers to permit repairs to be made without undue hazard. A platform built ten feet from the ground, and without guard railing, is particularly to be recommended, as it allows a lineman a safe means of clearing himself in case of an electric arc. The writer has personal knowledge of five cases where men avoided serious injury by hastily jumping from the transformer platform.

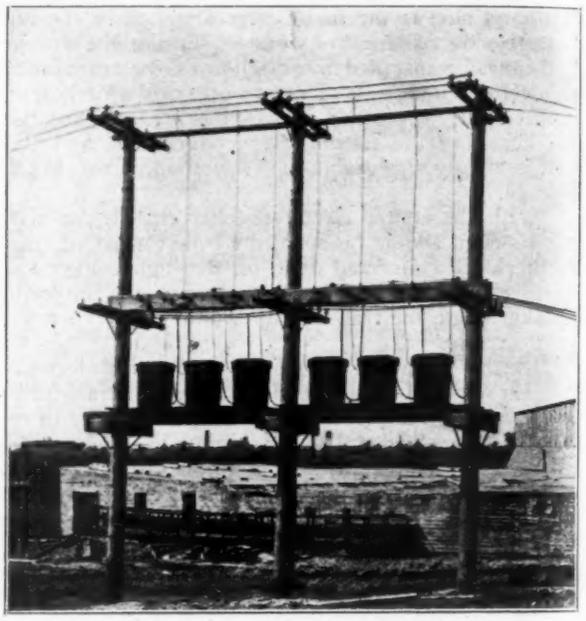


Fig. 2.—Ample Clearance and Arrangement of Platform Enable Rapid Change of Transformers.

Restoration of service without loss of time, in case of a transformer burning out, is of great importance. To facilitate restoration of service, the planking of the platform should not be nailed down and the supporting beams should be far enough apart to permit a transformer to pass between. A damaged transformer may then be drawn up by the over-head beam, the planks removed, and the transformer lowered to the ground. The new transformer may then be drawn up, the planks replaced and transformer lowered, and the whole operation performed without shifting the undamaged transformer, and without the use of any tools except a block and tackle.

The transformer platform illustrated, requires a minimum of material. The lumber required for a single transformer bank platform is as follows:

2...2-in. by 12-in. by 12 feet...yellow pine.
4...6-in. by 8-in. by 12 feet...yellow pine.
4...3-in. by 10-in. by 7 feet...oak.
12...3-in. by 10-in. by 7 feet...yellow pine.

The line illustrated in Figs. 1 and 2 serves a plant operating shovels in a clay pit, and manufacturing fireproof, hollow tile. The line is a 3-phase 2300-4000-volt, 4-wire, 60-cycle line, and the six 30kv-a transformers, operating in parallel on a star-delta connection step the voltage down to 440 volts.

Contracting-Construction

Sections 36 and 37, National Electrical Safety Code—Portable Bench—Cost-Keeping Books—Among the Contractors

PART III OF THE NATIONAL ELECTRICAL SAFETY CODE.

Rules for the Installation and Maintenance of Electrical Utilization Equipment—Sections 36 and 37.

[*The* ELECTRICAL REVIEW *has found that electrical contractors are quite unfamiliar with the National Electrical Safety Code, drafted by the Bureau of Standards, Washington, D. C. This new Code aims to minimize the life hazards connected with the use of electricity. Part III of the Code is of special importance to contractors, who will be called on more and more to make their installation work conform to its requirements. To acquaint them with this portion of the Code, Part III is being reproduced in these columns, Sections 30 to 35 having appeared in the issues of March 16, 23, 30 and April 6; Sections 36 and 37 with discussion appear below. The remaining two sections of Part III will appear in the following issue.*]

SECTION 36.—LIGHTING FIXTURES AND SIGNS.

360. Grounding.

The exposed non-current-carrying metal parts of all lighting fixtures and other similar fixed electrical devices shall be permanently grounded when used under the following circumstances (for exception, see Rule 304 *d*): (1) When in locations where explosives, inflammable gas, or inflammable flyings normally exist in dangerous quantities; (2) when within touching distance or about 8 feet from metal, concrete, or permanently damp floors or stairways, including fire escapes, galleries, or bridges, as in machine shops, stables, laundries, etc.; (3) when readily accessible from the ground or floor and also within 5 feet from conducting surfaces, such as metal piping, metal radiators, stoves, furnaces, plumbing fixtures, damp walls, or similar conducting surfaces, as in kitchens, machine shops, print shops, etc.

On the grounded systems it is recommended that the center contacts of sockets and receptacles be connected to the ungrounded side of the system, and the inner screw shell of the devices to the grounded side or neutral, in order to reduce the liability of breakdown of the dielectric between the inner screw shell and the grounded outer brass shell, and also to reduce the liability of injury to persons in replacing lamps. This is especially important in wiring electric signs.

In lieu of grounding the external metal parts of lamp sockets, where suitable means for grounding are not readily available (as sometimes is the case with knob-and-tube wiring not near plumbing fixtures), sockets and lamp guards or similar devices of suitable insulating material may be used.

361. Insulation.

Electric fixtures shall be provided with an adequate and mechanically protected dielectric (complying with the standardization rules of the A. I. E. E.) interposed between ungrounded current-carrying parts and those external surfaces which persons can touch.

Those current-carrying parts of grills, heaters and other heating devices, which operate at high temperatures and are necessarily exposed, are exempted. (Compare Rule 352.)

362. Exposed Live Parts.

Electric fixtures, including lamp sockets and lamp bases, plugs, receptacles, etc., shall be so designed and installed that no current-carrying parts will normally be exposed externally. (For exception see Rule 361.)

363. Accessibility and Guarding of Signs.

(*a*) Electric signs at an elevation greater than 30 feet above roadways or footways, or at an elevation above a roof greater than the distance from the edge of the roof, shall, if they require attendance while in position, be provided with substantial, safely accessible runways, ladders or platforms from which all replacements and other necessary adjustments can be made. Provision for supporting workmen by safety belts should be made in the construction and installation of signs so located.

(*b*) Electric signs outside buildings shall have no ungrounded current-carrying parts normally exposed to contact of workmen on or in the building. (Compare Rule 313 *b*.)

(*c*) The exposed non-current-carrying metal parts of a sign should be grounded if within reach of any grounded surfaces, including metal work of the building structure.

364. Control of Outdoor Signs.

Electric signs, located as noted in Rule 363, shall be provided with switches arranged to entirely disconnect all feed wires of the sign and either located within sight of the sign or arranged so that they can be locked in the open position.

365. Connectors for Signs.

Electric signs shall be so arranged that changeable connections can be made manually only by approved connectors in which all poles of the circuit are simultaneously interrupted. All current-carrying parts of pin and socket connectors shall be provided with approved guards, so as not to be exposed to contact.

366. Isolating or Guarding Lamps in Series Circuits.

(*a*) Arc and incandescent lamps and other devices in series circuits, except in grounded circuits of which no part exceeds 150 volts to ground, shall be effectively isolated or suitably guarded.

(*b*) All metal cable or chain supports for lamps shall be effectively insulated from the lamp or shall be permanently grounded.

Isolation will ordinarily be deemed sufficient when a vertical clearance of 8 feet is provided from floors or other ordinarily accessible places within buildings, of 10 feet from footways outside buildings, and of 15 feet from roadways. Horizontal clearance from windows, porches and other spaces accessible to the general public should be not less than 3 feet.

(*c*) Lamps shall be secured from falling on persons or traffic passing below, and the hanger, rope, chain or other means adopted for holding the lamps shall be regularly and systematically inspected. Metal chains or wire cables used for lowering lamps in series circuits shall be interrupted by a suitable strain insulator the minimum height of which from the floor or ground shall be 8 feet, whether the lamp is in position or lowered.

367. Safe Access to Arc Lamps.

A suitable device shall be provided by which each arc lamp or other device on series circuits may be safely and entirely disconnected from the circuit before it is handled, unless the lamps are accessible only to properly qualified persons, worked on only from suitable insulating stools, platforms or tower wagons, and treated always as under the full voltage of the circuit concerned.

SECTION 37.—PORTABLE DEVICES, CABLES AND CONNECTORS (NOT INCLUDING THOSE FOR SIGNAL SYSTEMS).

370. Insulation.

(*a*) Portable devices shall be provided with an adequate dielectric (complying with the standardization rules of the A. I. E. E.) interposed between ungrounded current-carrying parts and those external surfaces which persons can touch.

Toasters, grills, or other heating devices in which the current-carrying parts at high temperature are necessarily exposed, are exempted. (Compare Rules 352 and 361.)

(*b*) In locations where the dielectric is exposed to mechanical injury it shall be suitably protected.

371. Grounding.

(*a*) The permanent grounding of frames of portable devices (especially in connection with voltages above 150 to ground, and for any voltage when the devices are used within 8 feet of the floor in locations such as bathrooms, laundries, etc., where persons may easily touch grounded surfaces at the same time as the device) is recommended as a safety measure, where this is practicable and suitable means are available, but can not, of course, be reasonably required unless such means are available.

Such grounding may be obtained by the use of a three-wire portable cord with the portable device, one wire being used for the ground conductor and the connectors being properly designed so that wrong connections can not be made by the user of the device.

(*b*) In lieu of grounding the external metal parts of portable lamp sockets where suitable means (as above indicated) are not readily available, sockets and lamp guards or similar devices of suitable insulating material may be used, and should be used in the hazardous locations listed previously.

372. Cable Connectors.

(*a*) Where used with portable conductors it is recommended that connectors be used which necessarily disconnect both or all poles from the live source of energy where the circuit is opened.

(*b*) Connectors shall be so constructed (with guards when necessary) that the person using them can not inadvertently come in contact with live parts, or be burned by arcing when interrupting the largest current for which they are rated or marked.

(*c*) The end of a separable connector which is left alive, or the two ends of a separable connector where both are connected to live circuits (as in battery charging), shall have live parts suitably guarded.

(*d*) Where connectors are attached to portable cables, suitable means shall be provided for relieving the terminal connections of cable from strains.

(*e*) Separable connectors should, where practicable, be so designed that the plugs will not fit receptacles rated for larger currents than the plugs.

373. Identified Conductors, Cords and Connectors.

Where used with portable devices, the cases of which are designed to be grounded (see also Rule 371), the portable cable and the separable connectors (both to the device and to the circuit) shall, where practicable, be provided with identified parts; so that the ground conductor wire in both the fixed wiring and portable cable will always be attached to the proper terminals of the connectors. It is desirable that the fixed wiring also have suitable marking to distinguish the ground conductor from circuit conductors.

Separable connectors shall be so constructed that wrong connection between the two parts is impossible.

374. Use of Portables and Pendants.

(*a*) Portable and pendent conductors shall not be installed or used on circuits operating at over 300 volts to ground, unless they are accessible only to persons authorized to approach them. In such cases they shall be of a type suited to the voltage and conditions.

In car houses and similar locations where service at low voltage is not available and where necessary to use low-voltage pendent, or portable lamps or other devices in series with lamps on trolley circuits, the devices should be used only with great caution and be placed preferably on the grounded side of the circuit concerned.

(*b*) Where portable conductors are required, fixed sockets or connectors shall be provided at safely accessible points, attached, where practicable, to the grounded side of the circuit, and so located that liability of such conductors being brought into dangerous proximity with other live parts will be reduced as far as practicable.

(*c*) Where exposed to dampness or corrosive influences, portable conductors shall be of a type specially suited, and where exposed to inflammable gas or flyings they shall be so protected or isolated by elevation that they can not be readily damaged. In the latter case connectors shall be so arranged as not to be exposed to accidental opening by persons handling the portable conductors or devices. Portable lamps in locations where explosives or inflammable gases are normally present shall be incased in vaporproof globes with suitable mechanical guards.

(*d*) Portable and pendent conductors shall be so installed that no strain is placed on the terminal connections and shall have no joints except at suitable fittings.

(*e*) The use of worn or defective portable and pendent conductors should be avoided because of the danger to users by wire strands piercing the insulating covering or becoming exposed through abrasion of the covering.

DISCUSSION OF SECTION 36.

360. Grounding.

It is sometimes practicable to place lighting fixtures and less often other fixed electrical devices, such as heaters, cash registers, etc., where no grounded surfaces (plumbing, machines, damp floors) are within reach, and in such cases grounding is unnecessary as a protective measure. Lighting fixtures may be placed out of reach on ceilings and controlled by separate switches, frequently with advantage to convenience and illumination alike. If, however, fixtures must be placed within reach from grounded surfaces, and the entire exterior surface can not be of suitable insulating material (as with porcelain or composition sockets), the grounding of the fixture itself becomes advisable. This is especially necessary when surrounding atmosphere is damp, as in baths, laundries, stables, breweries and packing plants.

The grounding of fixtures attached to conduit and similar wiring systems is readily accomplished through the conduit or other metal covering. With wiring having no metal covering, a separate ground wire may be necessary. Grounding by means of a grounded conductor where this runs to the fixture has been sometimes recommended, but may in many cases be inadvisable, as introducing different voltages on different exposed fixtures and connected piping systems in the building, which may in turn produce unexpected currents in dangerous locations. The grounding of fixtures in this manner may be found practicable, however, when the fixture is not touching or in close proximity with metal ceiling, metal lath, gas piping, metal reinforcement of buildings, or similar conducting material which may introduce large currents in the grounded conductor of the circuit, or produce arcing at this or other points by reason of their discontinuous arrangement. Usually, however, grounding to neighboring water, heating or other piping systems (except gas) will be feasible, and provide an effective and desirable protective connection.

The grounding in case of combination gas and electric fixtures presents a peculiar problem. Gas piping is sometimes practically discontinuous by reason of comparatively high resistance joints. Its repair is carried on regardless of electrical considerations. It contains an inflammable gas. For these reasons the use of gas piping as the sole ground for a fixture should generally be discouraged (see Section 9). Insulation of the fixture from the gas pipe seems to be unnecessary where the fixture is otherwise well grounded and even distinctly bad practice where no other ground is available for the fixture. The grounding of fixtures not insulated

from gas piping, by means of a circuit conductor necessarily having a potential drop, is considered very inadvisable.

Combination fixtures and the proximity of gas pipes to electric conductors should be avoided wherever practicable, from both life and fire hazard viewpoints.

361. Insulation.

In the past, one defect of fixtures has been their inability to withstand in actual service the voltage between live parts within and the external metal shell. This weakness has existed in fixture stems with the conductor insulating covering and in sockets with the insulating lining. It has been constantly urged as a reason for not grounding the outer shell, although the absence of ground has meant more or less frequent leakage from one live part within to the outside casing and occasional injury or fatality to persons from contact. A fair solution of this problem seems to be the requirement that fixtures withstand under service conditions a suitable breakdown test from live parts to outer casing, and have exterior metal grounded as required by the preceding rule.

362. Exposed Live Parts.

Many shocks have resulted from the exposure of live parts where the ordinary public has access, and the hazard is greater where near much metallic piping or plumbing liable to be grounded. The frequent slight grounds of electrical circuits at other places makes it possible to establish a circuit between the exposed live parts and the piping. In some instances ordinary lighting-circuit voltages are sufficient to cause death, particularly in damp laundries, bathrooms and similar places.

By identifying circuit conductors, as is thoroughly practicable and now done in Providence, R. I., it becomes easy to fix the inner screw shell of all sockets and receptacles at approximately ground potential, reducing the probability of breakdown from the inner screw shell to the external metal of the socket and preventing the danger otherwise present, that persons will touch the ungrounded screw lamp base and at the same time the grounded outer casing.

363. Accessibility and Guarding of Signs.

As installed in the past, many electric signs have been so arranged that access for replacing lamps or making repairs has been both difficult and dangerous. When the sign overhangs a sidewalk, there is added to the danger of workmen being shocked or of their falling from the sign the danger to the public by falling tools and materials. These are minimized by providing the workmen with suitable facilities for access, together with means for securing themselves to the sign.

366. Isolating or Guarding Lamps in Series Circuits.

Series circuits are, in general, very objectionable in buildings or in spaces accessible to the general public. Even on poles out of ordinary reach, high voltages may, in places of public gathering, expose curious persons or children, and the severity of the high-voltage shocks possible under such circumstances warrants a much greater degree of safeguarding than is necessary with parts of lower voltages, such as are common with constant-voltage systems for interior wiring.

Even the supporting or lowering devices for lamps on poles or on span wires deserves careful guarding. Some companies use insulating rope to protect from shock any careless persons who may reach up and touch the lowering devices. Other companies place the lowering devices so high that the trimmer must climb the pole to reach them, and unauthorized persons are prevented from tampering with them.

DISCUSSION OF SECTION 37.

370. Insulation.

In most portable devices now in use in this country the dielectric between internal live parts and external metal parts is the sole protection of users against shock. The material necessary for the dielectric depends on the uses and the location. Treated wood fiber may be satisfactory where the conditions are dry and the temperature not too high, but is not satisfactory in damp locations. Mica and certain other materials are suitable where much heat is developed, as in an electric iron. The designer must use a material which while adequate is not too expensive.

The problem is particularly important, because portable devices, from their nature, are liable to be carried near grounded surfaces, and at the same time are subject to harder usage than are fixtures and fixed devices.

371. Grounding.

The grounding of external metal parts of portable devices is no less to be recommended as a safety measure than the grounding of lighting fixtures and other fixed devices. Indeed, the fact that portable devices are more handled, and may be carried into close proximity to plumbing and similar grounded surfaces, makes their grounding even more desirable. With portable devices, however, the grounding can be accomplished only through a portable ground wire. To protect this properly, while securing at the same time sufficient flexibility, is a problem which has been solved in other countries and for some devices in this country, by the use of identified conductors in the portable cable, the one used as ground wire to be used only for this protective purpose and not also for normal current carrying.

Because of the greater difficulties involved in grounding portable devices than in grounding fixtures, and because of the inadequate supply available of portable cord and connectors suitable for accomplishing the grounding, in the manner above outlined, it has been deemed, for the present, advisable that the rule be made only to *recommend* grounding, and to emphasize the especial need for such protection for portables on circuits over 150 volts to ground, where the life hazard is so greatly increased over that with lower voltages that not even the present difficulty in securing suitable cord and connectors arranged for grounding should permit the absence of this protection.

372. Cable Connectors.

The rule requiring that all poles of cable connectors shall be disconnected by a single operation may be met by the swivel-type connector, but this is not as desirable as the bayonet-type, which disconnects all poles simultaneously and can, therefore, not be so interrupted during the operation of disconnection as to leave a single pole connected and the portable cord and device possibly alive from this source.

373. Identified Conductors, Cords and Connectors.

Where portable cable must be depended upon to ground external metal of portable devices, the separable connectors must, of course, be of a type such that no connection of normally current-carrying parts to the terminals designed for the ground wire is possible with ordinary care by the person making up the portable cable and its attached connectors, nor in any event by the person connecting the separable connectors in practical use of the device. The employment of a separate and distinctly marked ground wire (a third wire with two-conductor cables) makes mistakes very unlikely. The ground terminal on each side of the separable connectors should be no less distinctly marked.

374. Use of Portables and Pendants.

Most engineers discourage the use of portable attachment cords in any locality, because of their liability to become mechanically damaged and because of the tendency toward their continued use after they become very unsafe by lack of insulation. Many devices, however, are necessarily portable and portable cords must be used.

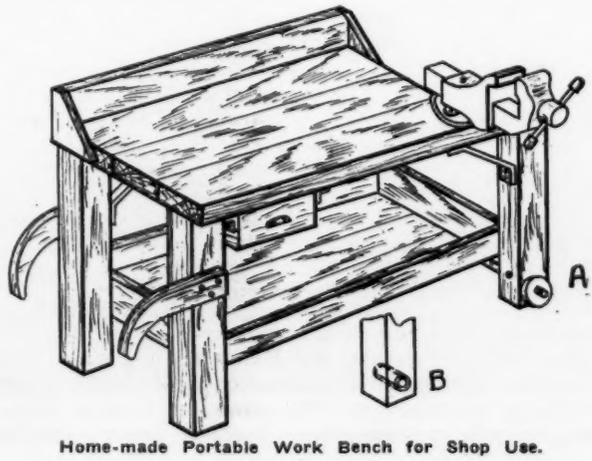
Limitations for their use are therefore difficult to set and at low voltages the use of portable devices and cords does not necessarily present serious life hazard. The rule, as given, indicates the cautions which should be observed where use of cords is necessary. In many car houses special low-voltage circuits are run in car pits and other places where the use of some kind of a portable light is necessary, to avoid the extra danger by use of the relatively high-voltage trolley circuit.

(To be continued.)

A USEFUL PORTABLE BENCH.

BY C. H. WILLEY.

The home-made portable work bench shown in the accompanying illustration is used in the writer's plant



Home-made Portable Work Bench for Shop Use.

and proves a valuable addition to the repair equipment, saving time and greatly facilitating overhaul work about the engines, generators and motors. Its construction is quite simple and hardly any description need be given, except to say that the length, width and height should be about 4 feet by 2 feet by 3 feet, to give best satisfaction. The axle passes through a hole in the base of the leg, shown at A. A section of brass pipe is driven in, as indicated at B, for a bushing, and thus prevents wear and tear on the wood with movement of the bench.

COST KEEPING FOR ELECTRICAL CONTRACTORS.

System of One Contracting Concern Which Employs Five Separate Books to Segregate the Accounts.

Keeping cost accounts in connection with electrical contracts may, in the opinion of some contractors, be simplified by entering items of different classes in separate books. Every concern, of course, may adopt a system of its own to some extent. One contracting company, whose blank forms for cost keeping are bound in convenient books, uses five such books in reaching the final result.

The first is the order book in which is recorded with aid of proper forms the terms and character of the contract; a second book carries the labor costs of each job, which comprise hours and rate of pay; in the third book is entered the amount and the costs of all material for each job; another book shows the overhead expenses of all jobs being put through, and a fair apportionment of the overhead to each of the several jobs. The fifth book contains a recapitulation pertaining to each of the different contracts, giving aggregate costs.

While few contracting firms keep what at first sight seems so elaborate a set of books, there are some advantages in the system described. For one thing, it permits keeping close tab on each set of expenditures—labor, material and overhead—so that unit costs are very readily obtained for different conditions. These are of very great value in estimating on other jobs.

AMONG THE CONTRACTORS.

The Reliable Electric Shop, P. C. McGillvra, owner, of Ottawa, Ill., lately installed twelve four-in-one light fixtures, made by L. Plaut & Company, in the junior children's department of the Public Library at Ottawa.

The Carroll Electric Company, Washington, D. C., has received the contract for considerable work on the distilling plant in connection with the naval radio station at Point Isabel, Texas. The amount of the contract is $47,500.

C. H. E. Williams, electrical contractor, having offices in both Vancouver, B. C., and Seattle, Wash., has secured a contract for wiring the ten 9400-ton steel ships now under construction by the Erickson Shipbuilding Company at Seattle.

The Wisconsin Electrical Equipment Company, Racine, Wis., is installing and connecting up motors of 137 horsepower in the machine shop of the F. J. Green Engineering Company, Racine, to operate shop machines in group drive. This electrical installation is replacing steam power. The motors are General Electric, 60-cycle, 3-phase.

Swords Brothers Company, Rockford, Ill., is wiring the new brick building of the Woman's Club.

H. Arout, electrical contractor and dealer, Aurora, Ill., is doing the wiring for light and power of the Miller Diabetic Sanitarium, the contract price being about $3000.

Hughett Electric Company, R. C. Hughett, manager, of La Salle, Ill., has about completed the fitting up of a new appliance and fixture store in the Kaskaskia Building, in that place, in which a work room is provided in the rear part. Fixture displays are provided for by box-beam construction below the ceiling proper, the beams being supported by pilasters on the side walls. A flush switch for each pilaster serves the lamps and chandeliers hung from each beam. Back of this display section is the office, and a balcony floor for stock.

NePage, McKenny Company, the well known firm of electrical engineers and contractors with head offices in the Armour Building, Seattle, Wash., and branches in chief Pacific Coast cities, is constructing a transmission line from Bremerton to Keyport, Wash., for the Bureau of Yards and Docks of the Navy, to cost about $9000. The company is also making the complete electrical installation in the Bradner Apartments, and is doing a large amount of work for the Emergency Fleet Corporation, the Portland and San Francisco offices also reporting considerable work of this nature.

Bond Brothers & Company, Evanston, Ill., are active in the contracting line, notwithstanding the quietness of building operations. One of the jobs they have under way is that of wiring the Hostess Cottage of the Y. W. C. A., at Great Lakes. This provides for 125 lights. The new hollow-tile residence building of H. S. Bunting, Lake Bluff, is being wired for 140 lights. They are also wiring the new building of August Kochs, at 1527 North Dearborn Street, Chicago, providing for 100 outlets. In connection with the remodeling of the residence of Robert Cluett, Hubbard Woods, this firm is doing the rewiring for 140 lights.

E. F. Pendergast & Company, Rockford, Ill., have about completed the conduit wiring, and installing the signal system, in the Swedish-American Hospital. The contract amounted to about $3700. They are also wiring the new concrete building for Swift & Company for light and power, and installing one motor to operate an ammonia compressor, and another for an elevator. This firm also wired the new seven-story, reinforced concrete building of the B. Z. B. Knitting Company, for light and power; and wired the seven-story bank and office building of Freeport State Bank, putting in all conduits for light, bell and telephone systems.

Henry Newgard & Company, Milwaukee, Wis., has completed the installation of motors and adjustable lighting fixtures in the factory of the Monarch Manufacturing Company, that city, which has big government contracts for making army and aviation uniforms. There are ten 1½-horsepower motors and eleven of 2½ horsepower, for operating sewing machines from line shafts. The 300 adjustable fixtures are such as to enable the operative to concentrate the light upon the sewing machine work at any desired angle. For this lighting a 10-watt lamp serves each machine. Two remote-control service switches were provided in the same building for the fire department. The same firm is installing the Bobroff nurse call system in Columbia Hospital.

Contractor-Dealer

Patriotic Window Display—Suggestions for Selling Current-Consuming Appliances—Increasing the Utility for Fans

AN INGENIOUS PATRIOTIC WINDOW DISPLAY.

Sterling Electric Company Aids in Thrift-Stamp Sale by Effective Plan.

That it is just as easy to be prógressive in patriotic activities as it is in commercial pursuits has again been demonstrated by the Sterling Electric Company, of Minneapolis, Minn., who for the present, at least, has stolen a march on the merchants of Minneapolis in the matter of Thrift Stamp publicity.

The accompanying illustration shows the window and store front of this company and tells the whole story. The idea involved is told by M. V. Rutherford, advertising manager of the company, as follows:

"I went to our Police Department and borrowed one of their semaphores that they use to direct the traffic in our downtown district. I had the sign camouflaged to read 'stop' no matter what side was observed. On the sign a large hand pointed towards the window display, reading, 'Uncle Sam is calling, answer him. See Window.' The window display consisted of a revolving platform, upon which was mounted a big framed picture of Wilson, backed up by a Thrift Stamp picture. The balance of display was Thrift Stamps and War Savings Stamps, and a red, white and blue banner reading, 'Be loyal to the U. S. A.' On the left side of the window, was a figure of a United States postman holding in one hand Thrift Stamps and in the other, a Baby War Bond card. The rest of window was decorated with appealing Thrift Stamp signs.

"On the opening day of the sale, we had two postmen selling stamps out in front of our door. Every day last week we had young women selling stamps to all passers-by. In the seven days' sale, we sold over $1000.00 in Thrift Stamps."

The whole idea was original with the Sterling Electric Company and it took so well that the newspapers published the picture and gave the company space for an extended description.

Thrift Stamp Window Display of the Sterling Electric Company, Minneapolis.

WHY WOMEN CAN SELL ELECTRICAL HOUSEHOLD APPLIANCES.

A Woman's Views on the Problems of Selling Electrical Goods and How to Meet Them.

By Anna A. Tietz.

There is scarcely a field of occupation today that does not employ women workers. During the last few years, or since the beginning of war, which has engaged so much of our best manhood labor, women have and are successfully occupying men's places in the industrial world that prior to the world conflict would have been considered unreasonable and perhaps absurd. The electrical field, heretofore considered perhaps altogether too technical for women, is receiving its share of consideration from women workers and today they may be found employed in many of its varied branches. A very pleasant field along this line for women, which is daily broadening, is the selling of electrical household appliances.

One of the greatest factors in the world replacing human labor is electric power, for which new uses are constantly found. One of the places that this "power giant" has entered to stay is the home. Its first entry in the home was the use of electricity for lighting purposes. Then followed the use of the electric washer, electric irons, etc., and today the list of the various useful appliances is too long to enumerate here. The annual sales of electrical household appliances now average millions of dollars, with each succeeding year showing an enormous increase.

Appliances Appeal to Women.

Women are more and more becoming educated to the fact that electric power in the home is not only a great time and labor-saving device, but a great money-saving device. Homes that once adopt the use of electric power never return to the old, slow, unprogressive methods of hand power. To the contrary, they continue to add more and more electrical appliances, thus shortening labor and lengthening life. Even on the farm, where the work in the home always has been heavy for women and a far greater drudgery than in the city home, electric power has brought about great changes and today is making the work a pleasure and the women happier and more contented.

Home electrical appliances, now carried by all up-to-date dealers, can be successfully sold by women. One reason perhaps is because woman understands woman, the same as man does man, and each generally prefers dealing with his or her own sex. A woman in making purchases, if taken care of by a saleswoman, feels at greater ease in selecting the article or articles she desires, entertaining no hesitancy in questioning their operation, durability, value, etc. A man when approached by a saleswoman in buying articles used ordinarily only by his sex not only feels less at ease than he would in dealing with a salesman, but in his mind (if not openly) he questions and perhaps sometimes underrates the saleswoman's knowledge of those particular tools or goods. This same theory applies to a woman when dealing with a salesman in buying goods which ordinarily only her sex uses. Then, again, the saleswoman has the advantage over the salesman in selling electrical household appliances because the woman naturally being the home-maker and caretaker, knows what is desired and required of such appliances. It is through the operation and use of them that she knows and appreciates their value, knows the special conditions each device has to meet, the same as the engineer, the electrician or mechanician, through application knows the requirements of his various tools.

A woman selling electrical household appliances knows and studies to know the different points in each of the various appliances that make the strongest appeal to her sex, and as a saleswoman she makes these points her basic, convincing and clinching arguments. In considering working comparisons she points out how electricity has the advantage in almost every detail.

Why Women Are Successful in Making Sales.

The electrical saleswoman's greatest asset, as that of any other saleswoman, should be her personality, or, in other words, her patience, politeness always, diplomacy, tact and understanding in handling of the human element. Much help can be given the saleswoman in selling electrical household appliances not only by practical drilling of handling and closing sales, good advertising and attractively arranged stock, but also by having timely and practical window displays. One of the greatest educators of the public today to the use of many articles in all lines is through effective and systematic advertising and through attractive and seasonal window displays. Many people are ignorant of the existence of many articles on the market until they see them advertised, or until their attention is directed to them in an attractive window display. Very often the appearance of a certain article in the window arouses their curiosity enough to enter the store or shop and ask the saleswoman or salesman to explain the use and operation of such an article. On entering an electric shop or electrical household department for the first time many visitors are greatly surprised and amazed to see the vast number of various useful articles that are on display. With few or perhaps none of the electrical appliances in their homes they are utterly ignorant of their actual existence and the use for which they are intended. Here is the saleswoman's opportunity to use her powers and diplomacy in patiently and tactfully explaining any article or articles the visitors appear interested in and calling to their attention other or new articles, forcefully dwelling on their usefulness, economy, instantaneous service, etc., without urging them to buy. The visitors who leave without buying and who are invited to "come in again" even though they do not purchase, leave with a pleasant impression and feel free and welcome to return and perhaps on leaving after the next visit, take with them some much admired article, which after consideration of its economy, its time and labor saving, they found they could afford to own.

Need Not Have Technical Knowledge.

To be a successful saleswoman of electrical household appliances a woman need not have the knowledge of an electrician, mechanician or college graduate. The fundamental and basic principles of electric power or current required and measured by wattage, voltage, etc., for various appliances, and the cost of current or power per hour of such device is quickly learned and explained. Many dealers make it a practice to have the cost of operation per hour of such devices marked on the price tag thereto attached. As a general rule, women in the home are not vitally interested or do not care to concern themselves with the mathematical or technical problems involving the operation of devices. Their primary consideration of such appliances is to know their use, their economy, their time and labor-saving qualities.

When You Install Electricity in Your Building

whether it be a home or business building, there are many points for you to consider that if given attention in your planning will save you future trouble and expense.

This little booklet, called "The Gateway of Electric Service," points out what many of these things are in a most instructive and entertaining way.

You will find it worth while to read this little pamphlet carefully before you have your electric installation made.

We will gladly supply you with a copy if you will call, write or telephone for a copy.

Just say you want a copy of the booklet "The Gateway of Electric Service."

No One Can Remove the Lamp Without the Master Key

P&S Shurlok Sockets

have proven their great value to hundreds of factories and business concerns, hotels, railways, boarding houses and similar places where electric lamps are frequently removed by thoughtless or dishonest persons.

Shurlok Sockets not only prevent loss of lamps; they also prevent the unauthorized use of electric current from a lamp socket.

When a lamp is put in a Shurlok Socket it is securely locked in the socket and can not be removed except by the holder of the master-key which is furnished with all Shurlok Socket installations.

Shurlok Sockets prevent loss of lamps, unauthorized use of electric current, and have many other advantages.

We can install them for you.

Two Examples of Free Copy Service Supplied to Dealers.

MANUFACTURER AIDS DEALERS IN EDUCATING CUSTOMERS TO STANDARDS OF BUYERSHIP.

One of the essentials in electrical merchandising is to keep the consumer's ideas of quality at a high standard. His conceptions of quality standards are mostly obtained from that branch of the trade with which he comes in contact. How important it is, then, for the contractor and dealer to uphold such standards of material product and construction as will induce the consumer to buy on quality rather than price. To talk price is to put quality and service in a secondary place and give the consumer an erroneous ideal as to standards in buying. In the matter of promulgating a sound sales doctrine, Pass & Seymour, Inc., Solvay, N. Y., have had prepared a useful trade booklet, intended for distribution by dealers among their customers. In fact, it amounts to a little treatise on *buyership*, specially adaptable to the dealers' customers. This firm lately had prepared a series of advertisements of its electrical equipment for the use of the contractor-dealer, each in printing-plate form, some of which are reproduced herewith.

An Important Point to Consider In Buying Electric Fixtures

Comparatively few persons have any idea of the importance in electric light fixtures of the little apparatus known as *the socket.*

Every time you turn your light on or off the socket has to work. When you pull the chain or turn the key of a socket it is just like opening or closing a little gate by means of which the electric current is switched on or off. That is why the socket is very properly called "The Gateway of Electric Service."

Good authorities have estimated that the average socket is called upon to operate from

Three Thousand to Four Thousand Times a Year

That is a lot of work and it means that a socket must be most carefully made of the best materials and skillfully installed if it is to continue to render good service year after year.

So you see the use of good sockets is a mighty important factor in your fixture installation.

That is why we use and recommend P & S Sockets made by one of the most reliable manufacturers in the business. They give long and reliable service.

This is just one of the important details showing the care we use in furnishing you with good durable lighting fixtures.

Don't Buy Your Electric Fixtures for Appearance Only

No one can appreciate more fully than we do the desirability of attractive design and good "style" in electric fixtures.

The property owner should, however, bear very clearly in mind when buying fixtures for a building that such equipment is put in to give *long time service* and that such service can be insured only by *quality* in both materials and workmanship.

Style ideas change from year to year. But you don't want to install fixtures every year. And *quality* stays at work for a lifetime.

Here is just one example of what we mean by quality in fixtures. The *socket* which holds the lamp is the *working part* of the fixture. If its insulation and mechanical parts are not of the best quality trouble is likely to result sooner or later.

P&S Sockets

made by one of the oldest and most reliable factories in the business and whose product is fully approved by the National Board of Fire Underwriters.

That is just one detail to show you the care we exercise in seeing that you get the kind of fixtures that give *long time service.*

P&S Brass Key Socket

Two Advertisements That Aid Dealers to Educate Customers.

Making the Electric Fan More Useful

Second Article Aiming to Increase Utility of the Common Fan—How it May be Used to Aid Ventilation, Heating, Drying and Other Purposes

VENTILATION, in the most generally accepted sense, consists in changing the air in a room either by introducing fresh air, removing the foul air, or both. While many ventilating experts insist that both processes must be carried on to secure effective ventilation, and mechanical ventilating systems usually provide for both, at least for large interiors, it is also true that for small interiors natural ventilation is most commonly relied on by opening windows, transoms and doors. Fresh, outside air is permitted to enter and the vitiated air allowed to escape whither it will. In the case of kitchens, laundries, toilets, etc., where the foul air must be removed without permitting it to pass to other rooms, exhaust or ventilating fans are employed.

Even with such simple natural ventilation of smaller rooms an electric desk fan can often be used advantageously to aid the natural current when the wind is absent or strong convection currents due to marked differences between indoor and outdoor temperatures do not exist. In this case the fan is placed on or near the sill of the open window and turned so as to blow inward, thus drawing in fresh air that otherwise would not enter naturally in sufficient quantities. Of course, the fan must be placed so as not to cool any one by its direct breeze, if that should prove objectionable. High speed is usually not necessary. This simple arrangement has been used effectively, for instance, for supplying fresh air to a sleeping room on nights when no natural breeze or cool air currents would enter.

In the first article of this series it was pointed out that certain ventilating men, basing their opinions on the results of tests like those made by Dr. Leonard Hill, contend that it is unnecessary to ventilate by complete removal of the air several times an hour, but that partial removal suffices as long as the air is kept in motion by the liberal use of fans. In fact, this scheme is used by many motion-picture theaters to improve the quality of the air. In this case oscillating fans keep the air in circulation and at the same time moving in a general direction toward the outlets and exhaust fans. The same plan can be used effectively in many large offices, school rooms, factories and other places where considerable numbers of persons are present. The oscillating fans will serve as very efficient aids to natural ventilation, if no other ventilating equipment has been installed, and even will materially aid mechanical ventilating systems in securing a more thorough penitration of the fresh incoming air into all parts of the room and in preventing the tendency to short-circuit from inlet to outlet. High-speed fans should not be used for such service so as to prevent cooling drafts. The fans should be turned so their prevailing breeze is in the natural direction for air movement in the room.

It should be noted that the statement formerly made by certain ventilating interests that electric desk fans are of no value for ventilation, has no foundation. It may be admitted that they are not the complete solution of the complex ventilating problem of a large interior, but they do have a place—an increasingly recognized place—as a material aid to both natural and artificial ventilation. Moreover, it should be noted that they may be used, if placed and directed with judgment, so as to aid ventilation without cooling the occupants of the room. They will make the temperature of the room more uniform throughout. Oscillating fans are best for this purpose, but the non-oscillating types may also be employed in many cases, especially in the smaller rooms.

Increased Utility for Electric Fans.

In the ELECTRICAL REVIEW *of February 16, 1918, appeared the first article of this series. It was shown that the electric fan was the first portable electrical appliance to come into much use, and now, after 25 years, is still used almost exclusively for cooling only and then but for a short season.*

Methods for increasing its efficiency as a summer breeze maker were pointed out. The value of using fans even on moderately hot days was also shown.

Use of electric fans for materially aiding ventilation, aside from any cooling action, was briefly explained.

In this article this subject is continued and other uses for electric fans pointed out.

In a third article will be discussed some of the ways in which manufacturers, central stations and dealers can aid in increasing the use of this valuable appliance.

ELECTRIC FANS FOR HEATING.

The assertion that electric fans may be employed for heating purposes at first strikes the average person as a wild fancy of a fan enthusiast, but this is only because the fan has been so firmly fixed in the public mind as a cooling medium. The fact is that the fan is not a heater, but only a breeze maker. If its breeze is directed over a heating medium the breeze will naturally become warmed and in turn may serve to warm the room more effectively and quickly than if reliance is placed on the unaided convection currents from the radiator or other heating device. For instance, to warm a cold room in the morning, turn on the steam radiator and place a fan on the floor with its breeze directly blowing against the radiator. The heat of the latter will be disseminated much more quickly throughout the room.

There is nothing wonderful about using a fan to aid heating. It has been done for many winters in connection with hot-air furnaces. The heated air from these seldom warms the windward side of a house on a very windy day, due to the wind leaking in through crevices around windows, doors, etc., and pressing the hot air back in the ducts. A fan placed in the duct near the furnace will force the warm air into the cold rooms and make it possible to get at least fairly comfortable conditions. Where indirect systems of heating are used in connection with steam heating coils in the basement, fans of course are employed to force the fresh air over these coils and then through ducts to the various rooms, although as a rule such fans are necessarily much larger than the ordi-

nary desk fans and have the driving motor outside the air duct. What is possible on a large scale is also possible on a smaller scale and much greater use of electric fans should be made in this way.

Such use of electric fans aids not only heating but also ventilation in that it brings about the entry of fresh air into the room and causes a more active circulation of the air in the room. In fact, the fan can be used for this dual purpose in places where no air-duct system has been installed. A cover is placed over the lower part of the opened window and a fan placed within it with a short duct arranged so that the fresh air is blown against the radiator below or adjoining the window. In this way the fan will combine fresh-air ventilation with heating in a very effective manner in old buildings in which no ventilating equipment has been provided. This scheme has been used in numerous offices and has been found to increase the efficiency of the employes materially.

Use of Electric Fans for Drying Clothes, Fruits, Vegetables, Etc.

Clothes that have been washed have been hung outdoors to dry from time immemorial. Natural drying in this way is effected both by the heat of the sun and by action of the breezes; in the absence of sunshine, of course, the latter action alone prevails. On rainy days clothes cannot be hung outdoors to advantage and in very large cities absence of yard space makes it rather uncommon for clothes to be hung out. Drying indoors can be effected in the same way as in a yard, however, both heat and breeze serving to hasten the evaporation of the moisture. Heat, of course, evaporates it directly while a breeze removes the humid air around the clothes and replaces it by relatively dry air, thus greatly facilitating the evaporation in many cases without use of any heat whatever. In laundry dry rooms it has been found that both heat and artificial breeze when combined give the quickest and best drying action. In the home clothes drying by the aid of an electric fan has been found very effective as a means of saving both time and heat, both of which must be conserved in these strenuous days. It should be brought to the attention of householders, who in but few cases know of it.

Considerable study was given by the Food Administration and the Department of Agriculture last year to the most effective means of preserving the considerable quantities of vegetables and fruits that were raised last year as the result of the home-gardening movement. These perishable products were grown in such amounts as to exceed in many cases the requirements of immediate home consumption. The ordinary methods of preserving require considerable quantities of sugar, which has been a scare commodity for many months. If waste was to be prevented, some other method of preserving was evidently needed. Fortunately, in the old and tried method of drying, modernized for present needs, the solution was found.

Many fruits have been sold in dried form for many years, such as raisins, prunes, apricots, etc. Drying permits sale and use of such products out of season and shipments to long distances without spoilage. This is because decay of perishable foodstuffs requires the presence of moisture, which forms a large constituent of fruits and vegetables; by removing the moisture decay is prevented. The old method was to hang up the fruits, etc., on strings and expose them to the air for several days or weeks, if necessary. Nowadays this is too slow. The electric fan has been found to be the modern solution.

The fruits or vegetables are placed on strings or, better yet, trays made with coarse cheesecloth or screening for the bottom. Several such trays can be superposed and elevated a foot or so over the table. An electric fan is placed so as to blow its breeze upward through the trays. If a small quantity of material is to be dried, strings will serve nearly as well as trays. The breeze from the fan brings relatively dry air in contact with the fruits, drying them very quickly and in a sanitary, convenient and economical manner.

The food situation is more acute this year than last and home gardening is being urged much more actively than a year ago. The experience gained last summer will result in larger and more valuable garden products. The sugar situation is not much improved. Consequently electric fans should be used to a much greater extent for drying garden truck than last fall. But the public must be informed of how the fan can be used advantageously for this purpose.

In the home, drying the hair is a difficult problem. Special electric hair driers, with heater and fan combined, have been used. In winter a common desk fan may be used, however, by placing it next to the top and end of a steam radiator so as to blow the warm air across the radiator top.

Miscellaneous Uses for the Electric Fan.

It is not the purpose of this article to discuss all the possible uses for the common electric fan, but rather to indicate how quite a few simple applications of it that are but little known to the public in general can be employed to much advantage. Before closing, it may be worth while to call attention to a few others that illustrate the great utility of this handy electrical appliance.

Merchants have come to realize the value of store-window displays in attracting the public attention to their wares. Of course, the first need is to have the window in condition that it may be seen through. During very cold weather frost on the windows nullifies their display value. It was found many years ago that electric fans blowing against the inner window surface will remove or prevent frost. This action is due to bringing warm, dry air from the store interior against the glass surface so that any frost there may be on it is evaporated, and its further formation prevented because the temperature of the glass is raised to above the frost-formation point. This is a very simple and inexpensive means of keeping the windows clear and is much safer and superior in every way to use of a row of gas jets along the front of the window at the bottom.

In the way of window displays also may be mentioned an effect that is not new but very timely. The country is on the *qui vive* about the war and displays of military or naval objects arouse keen attention. Nothing is more suitable in finishing off such a display than our splendid Stars and Stripes blowing its folds in a breeze easily produced by an electric fan. In entertainments likewise a charming effect is produced by raising Old Glory on a flag pole in the presence of the breeze of electric fans.

These are but simple illustrations of how useful a fan can be made for a variety of purposes and they show that the common notion that it is to be employed for cooling only and then put away the rest of the year is all wrong. In the concluding article of this series, to appear in an early issue, will be discussed what central stations, fan manufacturers and dealers can do to bring these as yet almost unknown uses to the attention of the public.

SUGGESTIONS FOR SELLING CURRENT-CONSUMING APPLIANCES.

Dealers Should Work in Harmony With Central Stations—Must Know Rules of Utility Company.

By Thomas F. Kelly.

Commercial Manager, Dayton Power & Light Company.

[The following is a condensed report of an address delivered before a recent sales conference of dealers and salesmen of an electrically operated water heater. The points brought out by Mr. Kelly, while intended for the education of dealers who may not already be familiar with the electrical industry, they are equally applicable to the electrical contractor-dealer.]

There are many dealers of electrically operated necessities that seem to overlook the fact that the representatives of the various central stations in their territory are worth becoming acquainted with—having in mind maximum sales of their electrically operated appliances.

I would suggest, if you have not already done so, that you immediately get in touch with the commercial manager of the central station in your territory.

Arrange to demonstrate your product to him and his salesmen at one of their meetings, and get them to become "Boosters" for your product. This is where your personality will count—become a friend of these men and they will soon be a factor in your increased sales.

If the central station has a show window, offer to arrange a window display of your product. You will find in many instances the commercial manager will welcome this because it relieves his men of the expense and worry of preparing a display for that particular week.

Do not put in the window display and then forget about it. Make sure the office people who come in contact with the public have a good idea of the operation of your system, its intial cost, cost of operation and maintenance expense. Furnish descriptive literature for distribution, but not in such quantities that it will be wasted. Always remember, printers' ink costs money and that there is always a possibility of it reaching the waste-paper basket when in quantities too great for active distribution.

Co-operate with Maintenance Department.

After making the acquaintance of the commercial men do not overlook the head of the maintenance department, as we refer to our "trouble" department here in Dayton.

Get close to him and his men. Educate them as to the construction and operation of your product. If you do this you will be relieved from many worries.

Imagine a "trouble" man of the central station on a visit to a customer—some slight trouble may have developed with your water system which is easily remedied by this man through his knowledge of your product. This sort of co-operation eliminates unnecessary loss of time, makes for efficient service and results in a satisfied customer for the central station and the manufacturer.

Electric Service Rules.

I have mentioned the importance of your educating the employees of the central station and now would recommend your becoming familiar with the established rules of the central station regarding service.

Service conditions should be determined before deciding on the style of motor equipment for pumps. A pump motor of improper characteristics might be located on the extreme end of a long secondary line, its operation causing a decided voltage fluctuation very annoying to the pump customer and other electric customers in his vicinity. Such a condition on the lines of a central station desirous of giving good service eventually requires changes in the motor equipment, which means additional expense, loss of time and dissatisfied customers.

CO-OPERATION BETWEEN CENTRAL STATIONS AND ELECTRICAL CONTRACTORS.

Attention may be called to the co-operative arrangement in some localities between the central station and electrical contractors. For instance, in the territory served by the Public Service Company of Northern Illinois that company keeps pretty well out of the contracting line, and in handling house-wiring and other work, that comes to it in connection with contracts for light and power, the jobs are turned over to the local contractors. Under this arrangement, however, the company furnishes specifications for the work; and when the work is completed it sends its own inspector to report on the job before a connection is made for service. At the same time, the signature of the contractor to a statement that the work has been done according to specifications is secured; and the customer's signed statement, to the effect that he is satisfied with the work as performed, is obtained. This record is kept on file by the company. In case the job is to be paid for on the time-payment plan, the company pays the contractor 90 per cent of the contract price in cash and assumes the responsibility of collecting the deferred payments. Thus, the contractor does the company's work as a sub-contractor. In other instances, wherein the contractor takes a wiring job to be paid for on the deferred-payment plan, he performs the work, subject to the company's inspection, and then may turn the matter over to the company, receiving 90 per cent of the face of the contract in cash, the company undertaking to collect the deferred payments. All this, of course, is a matter of pre-arrangement between contractor and the service company, the latter co-operating in work which opens new avenues of service.

A SUCCESSFUL CASH SALES POLICY.

The Mohr-Jones Hardware Company, Racine, Wis., which conducts an electrical appliance department, has adhered closely to the cash system of sales. On this basis the sales of appliances in 1917 amounted to $6000. Included in these sales were washing machines, vacuum cleaners, ironers, electric irons and toasters. It is explained that a 3-per cent discount is made for sales over the counter and for well rated customers a credit of 30 days is given, and a 2-per cent discount is offered for cash in 10 days. But, with this firm, the monthly-payment plan has not been put in practice at any time. Racine has a great industrial payroll and wages are high. Sales undoubtedly could be greatly increased by offering to sell on the easy-payment plan and by personal calls at residences; but this company does neither. It relies on circulars, letters, local newspaper advertising and window displays to induce customers to come in. Its idea is to grant short-time credit in some instances, but not to induce credit sales. This keeps the business virtually on a cash basis and obviates the expenses incidental to bookkeeping and collecting necessary under the monthly-payment plan.

Electric Vehicles

Electric Trucks Relieve Railroad Congestion—Live Stock Moved by Trucks—Electric Vehicle Promotion in Chicago

ELECTRIC TRUCK RUNS BETWEEN CHICAGO AND CLEVELAND.

The congested railroads and railroad terminals and abnormal amount of freight to be handled have caused a number of motor-truck fleets to ply between cities with groceries, perishable goods and general merchandise. This work has been confined very largely to gasoline trucks. While these trucks have succeeded in making deliveries the roads have suffered under this strain, especially, during last winter, and troubles and delays have occurred in deliveries as the roads became worse with time and the cost of maintenance of tires and moving parts increased accordingly. Nevertheless these fleets of trucks have and are doing good work and in most cases are managing to make profit for their owners notwithstanding the high cost of upkeep of the trucks.

In the past the electric vehicle has been looked upon as a vehicle for short hauls in the city at low speeds. This field it serves admirably, without a doubt. However, there is an impression that the electric truck is not adapted to long hauls. While this is true, based upon one battery charge, it is far from true if a battery exchange system is in vogue en route. It is just as necessary to re-charge the battery of the electric vehicle, or change batteries as it is to fill up the gasoline tank of the gas truck.

Three-Ton Electric Truck Carrying One Ton Overload That Traveled the 415 Miles Between Chicago and Cleveland in 52 Hours.

That the electric truck may, and with advantage might, be used for long hauls was emphasized recently when an electric truck made a run of 415 miles between Chicago and Cleveland. The truck was a 3-ton Walker, belonging to the Reid, Murdoch & Company, of Chicago. This firm operates some twenty trucks for transportation of wholesale food products in the city and suburban districts.

It was necessary to deliver some merchandise in Cleveland on short notice, and the delays due to congestion of freight sheds, car scarcity and so on could not be tolerated. One of their three-ton trucks was accordingly loaded up with 8164 pounds of merchandise—one ton overload—and sent on its way. It traveled the distance, 415 miles in 52 hours, actual running time, and without hitch or trouble, notwithstanding an overload of one ton.

It is thought there is a wide field for regular runs of this sort, for shorter distances, such as between a city and outlying towns, fifty to a hundred miles apart and even more. Good roads are gradually coming, and the electric is not nearly as rough on roads as is the gasoline truck. Battery exchange stations—or charging stations—might be necessary for the longer runs. Where distance and roads permit the electric truck would show lower operating cost than the gasoline.

MOVING LIVE STOCK BY MOTOR TRUCK.

During the last year the highways leading to Cincinnati came into very wide use for the hauling of live stock to the stockyards of the city limits by motor trucks. This method of transportation is comparatively new and grew out of railway congestion which compelled farmers to find other ways of reaching market. During last year there were hauled over highways from a radius of 30 miles 77,244 hogs, 23,618 sheep, and 28,545 calves, with 27,721 head of cattle, about 40 per cent of which were driven in on hoof and the rest hauled in motor trucks. The driving of cattle to market has not been found profitable, as they can not be driven any distance in cold weather, while in hot weather the trip causes overheating, deterioration of flesh, a slow market with the packers and lower prices. Cattle are being brought in in specially constructed auto-trucks, and hogs and sheep are hauled in double-decked motor trucks. With good roads around Cincinnati it is reported that such transportation promises to be permanent, the stock being hauled cheaper than by railway, arriving in better condition and in quicker time. This is work the electric vehicle could well do in many places.

ELECTRIC VEHICLES IN NORWAY.

Electric vehicles are now receiving considerable attention and encouragement in Norway for every form of mechanical propulsion. Heretofore gasoline cars have been practically the only machines in use in the country. For several months past no gasoline has been received, and as there are but few electric cars in Norway, automobiles have practically disappeared.

Helping the Electric Truck in Chicago

Commonwealth Edison Company's Advertising and Educational Campaigns on Garage Service Encourage Use of Electric Trucks in Chicago

IT WAS at the close of last year that the Commonwealth Edison Company's electric garage, located at Jackson Boulevard and Morgan Street, was completed. The garage was designed primarily for the reception of electric trucks, where they would be garaged, washed, cared for and their batteries maintained in efficient working order. For this service the owner of a truck would pay a definite monthly sum plus the cost of battery charging, in this way being relieved of all matters pertaining to the truck outside the initial investment, payment of taxes, insurance and drivers' wages.

Since that time the Commonwealth Edison Company has carried on its campaign for encouraging truck owners and others having transportation to do to investigate the electric truck, and, if they desire, to take advantage of the rentable garage service inaugurated by it. It has been felt that the ability to own a truck and yet be relieved of practically all the uncertainty as to performance and costs and troubles of maintenance would go a long way toward helping the prospective truck owner who, alone, lacked facilities for launching out upon scientific electric trucking, and thus encourage the more general use of the electric truck. Since the garage has been completed the company has maintained a deliberately planned and conscientious campaign for educating companies and individuals in the possibilities of the electric truck, pointing out how by its garage service the electric truck is now within the reach of all from the smallest to the largest owner. This campaign, frank and convincing, is now bearing fruit.

Reaching the Prospective Truck User.

The company has and is employing many, perhaps most, methods of reaching the users and prospective users of trucks. There is the medium of the mail for delivering independent folders and letters addressed to individual truck users. Through the same channels monthly power and electric light and fixture bills may have advertisements printed on the bills or sent out separately in the same envelope. Even the envelopes themselves may have printed upon them advertising matter telling of the electric truck. Billboard advertising is another means by which the truck user may have his attention drawn toward the economy of the electric truck, although this method, while giving wider publicity than the mails, covers less fertile ground. Advertisements in the daily and weekly local newspapers are doing their part in reaching the possible truck user.

Direct letters sent out to commercial concerns and probable and possible truck users, in fact, all being likely to use mechanical methods of transportation, have brought satisfactory results. These letters take a weekly, semi-monthly or monthly form and tell of some phase of the transportation situation, of the electric truck and what it has and can accomplish. Some examples of these letters are shown herewith. Each letter aims to strike to the heart of some vital factor of the day. Each letter is timely, terse and yet complete. The aim is to say enough and yet not befog the issue. And after attracting attention and holding the interest, each letter eventually comes back to the company's offer of its new garage service.

> "Electric Motor Trucks are built to suit your particular business. They will perform your delivery service cheaper and give more constant satisfaction than any other means of transportation.
>
> We know this and are prepared to prove it by making a contract with you by which all the principal factors of your operating cost will guaranteed for the next four years.
>
> Our large Service Station at Jackson Boulevard and Morgan Street will garage and maintain one hundred trucks on this basis.
>
> Shall we count you among the few keen business firms which will seize this opportunity to save

Fig. 1.—Thirty of These Trucks Convertible for Ice or Coal Are Seen Daily in Chicago. Ten More Will Soon Be With Them.

THESE PROMINENT CHICAGO COMPANIES HAVE ADOPTED ELECTRIC TRUCK SERVICE—*THERE'S A REASON*

Name	No. of Trucks
BAKERS	
Ward Baking Co.	60
Schulze Baking Co.	23
H. Piper & Co.	4
Powers Baking Co.	4
Oak Park Baking Co.	2
BREWERS	
Manhattan Brewing Co.	12
Anheuser Busch Brewing Co.	7
Gottfried Brewing Co.	6
Pilsen Brewing Co.	5
Heilman Brewing Co.	2
Fortune Brewing Co.	1
The Best Brewing Co.	1
Sieben's Brewery Co.	1
CENTRAL STATIONS	
Commonwealth Edison Co.	182
Public Service Co. of Northern Illinois	7
COAL AND ICE DEALERS	
Consumers Co.	30
Peoples Pure Ice Co.	2
Lincoln Ice Co.	4
DAIRYMEN AND ICE CREAM DEALERS	
Anderson & Goodman Ice Cream Co.	11
Blue Valley Creamery Co.	8
McBride Bros. & Knobbe Ice Cream Co.	3
O. H. Geyer	3
Weiland Ice Cream Co.	2
Hydrox Co.	1
National Milk Co.	1
DEPARTMENT STORES, ETC.	
Marshall Field & Co.	271
Carson, Pirie, Scott & Co.	80
The Fair	53
Mandel Bros.	52
Boston Store	13
Chas. A. Stevens & Bros.	3
Gage Bros. & Co.	1
DEPARTMENTS OF CITY	
Lincoln Park	3
Department of Gas and Electricity	2
EXPRESS AND HAULAGE COMPANIES, ETC.	
American Express Co.	88
Olson Cartage Co.	5
Burke Bros.	2
Fancher Bros. (Livery)	2
A. T. Willett Co.	1
FURNITURE DEALERS	
A. H. Andrews	1
GROCERS, CONFECTIONERS, FISH DEALERS, ETC.	
Case & Martin Co.	63
National Tea Co.	15

Name	No. of Trucks
GROCERS, ETC.—Continued	
Reid, Murdoch & Co.	20
H. J. Heinz Co.	3
Claussen & Son	3
Shields, M. Co.	1
Lake Superior Fish Co.	1
W. F. McLaughlin & Co.	1
LAUNDRIES	
Edgewater Laundry	2
Quality Wet Wash Laundry Co.	2
Schlecht Bros. & Co. (Towel Supplies)	1
MANUFACTURERS	
Western Electric Co.	3
General Electric Co.	3
Chicago Mill & Lumber Co.	2
Grand Crossing Tack Co.	1
Wm. Erby & Sons	1
General Chemical Co.	1
A. O. Fisher & Co. (Cigar Boxes)	1
MISCELLANEOUS FIRMS	
A. Dickinson Co. (Seeds)	9
American Posting Service (Bill Posters)	4
Chicago & Northwestern Ry.	2
Machinists Supply Co.	1
Pure Carbonic Co.	1
Western News Co.	1
Ernest Weinhoeber (Florist)	1
Montgomery Ward & Co.	1
Riverview Park	2
PACKERS	
Arnold Bros.	1
Hammond Packing Co.	1
Fulton Packing Co.	1
RESTAURANTS AND CATERERS	
John R. Thompson Co.	15
Messenger's	4
Chas. Weeghman	4
Delco Lunch Co.	4
Wm. M. Walker	2
Horn & Hardart Automat Co.	2
John B. Gaper	1
STRUCTURAL FIRMS AND FOUNDRIES	
Jos. T. Ryerson & Sons	2
Reedy Foundry Co.	1
A. H. Anderson	1
Crane Co.	2
Lammert & Mann	1
VEHICLE AND BATTERY MANUFACTURERS	
Walker Vehicle Co.	4
Electric Storage Battery Co.	2
Anderson Electric Car Co.	1
Edison Battery Co.	1
K. W. Battery Co.	1

Fig. 2.—Like a Magnet, This Convincing List of Satisfied Electric Users Draws the Interest of the Prospective Truck Operator.

money and insure delivery service in the four uncertain years to come?"

"All due credit must be given the horse-vehicle and gas-truck, but for city work use the Electric Truck if you would conserve feed and gasoline and reduce trucking at the same time.

Night-made electricity is the logical "fuel" for city trucks and far cheaper than any other fuel on the market.

Over 1000 electric trucks are now in service in Chicago and these are delivering the goods at lowest operation cost, for their owners.

We are prepared to make a four year contract with you which will definitely fix your cost, if you will use electric trucks operated from our New Service Station at Jackson Boulevard and Morgan Street.

The enclosed folder tells you about our New Electric Truck Service. Take time to read it today, then ask us to give you the figures."

"Have you noticed the increasing number of Electric Trucks on the streets lately, and particularly during the past stormy weather? Chicago merchants are realizing that they are the most practical, economical and service-giving motor vehicle, are ordering additional Electric Trucks to replace other vehicles.

Where can you find today a vehicle that meets War Time Requirements of Economy and Fuel Conservation to cope with the Electric Truck?

If you will use Electric Trucks we will guarantee their economy for four years, provided you contract with us to keep them in our New Service Station at Jackson Boulevard and Morgan Street."

"The blizzards this Winter have hit the Chicago merchants hard, due principally to the loss of trucking horses.

Mr. H. L. Roberts, Superintendent of the Anti-Cruelty Society tells us that 86 horses were shot last month because of injuries sustained in falls on icy pavements, and 368 others were ordered off duty.

These startling facts are turning merchants to Electric Trucks—the most reliable and economical means of transportation for city service today.

It is sound business judgment on your part to adopt Electric Trucks, and if you will do so, we will contract with you to definitely fix your trucking costs for four years and keep your trucks in our New Service Station at Jackson Boulevard and Morgan Street."

"Electric trucks show their stamina and power of endurance where the work is hard and steady. They are built of high grade material, have power that prevails, speed that satisfies and you can depend on them to give you satisfactory service in all kinds of weather, at the lowest operating cost.

The fact that bakers, coal and ice dealers, dairymen, grocers and many others use Electric Trucks every day proves their greater usefulness particularly for city service.

We know that it takes time to sell a man the electric principle of trucking but once we get the opportunity to demonstrate its efficiency as compared with other vehicles, there is but one result—more Electrics.

If you will use Electric Trucks, we will contract with you to definitely fix your trucking costs for four years and keep your trucks in our New Service Station at Jackson Boulevard and Morgan Street."

It might be pointed out that the Commonwealth Edison Company's offer to guarantee the cost of operation for four years at once proves its knowledge and faith in electric truck performance, and immediately removes the uncertainty from the transportation problem so far as the electric truck is concerned.

Another method of arousing interest in the electric truck—and one of the methods that has proved exceptionally successful—is to circulate in folder form a list of Chicago's satisfied users of electric trucks. A list that has brought in a large number of inquiries and requests for trial performance is shown in Fig. 2. This list is not, however, up to date, for since distributed a number of additional trucks have been ordered. Amongst the very latest additional orders are those of the Consumers Company for ten 3 and 5-ton trucks, Schulze Baking Company 10 trucks, Peoples Pure Ice Company two 3-ton trucks, Wet Wash Laundry Company four trucks, Crane & Company one 3-ton truck, Dixie Cotton Felt Mattress Company two 1-ton, one 2-ton, and one 3-ton trucks, besides a number of orders for single trucks.

Two of the largest teaming companies in Chicago and vicinity are at present operating each a 5-ton truck, making rigid comparisons with their large fleets of gasoline and horse-drawn vehicles, with a view to determining the desirability of discarding gasoline trucks and horses.

Another interesting development is that the Frank Parmelee Company, operating a large transfer and bus service in Chicago between railroad depots and hotels for baggage transporttion and so forth, has recently

Fig. 3.—Silent and Businesslike, Rapid and Odorless, the Electric Truck Delivers Ice Without Loss of Time and With Minimum Loss of Ice. In Summer When the Demand for Ice Is at Its Peak the Electric Goes Its Way Where the Horse Fails.

ordered an electric bus to hold 12 people, to be used for service between railroad terminals and hotels.

It has been said that the electric sells itself after one has been sold. This is very largely true, but not wholly so. However, it has been found that the satisfied electric truck user makes the best salesmen, and perhaps there is no better sales argument to employ with a prospective user than to refer him to a number of satisfied users of electric trucks. To do so not only proves the open-mindedness of the central station, but encourages the prospective buyer, and the trust and optimism thus bred usually clinch the deal. Imitation is the height of flattery and nothing could flatter the electric truck more than for a user to keep on buying electric trucks when needing more transportation facilities. Yet the more electric trucks the large user possesses, the more he seems to like them, and it is safe to say when in the market for means of transportation it is the electric truck that is chosen. Marshall Field & Company did not buy their 270 odd trucks all at once any more than did the other large department stores who with their 470 odd trucks have cut their delivery costs to a minimum.

The Trial Performance.

Acts speak better than words. It is performance that counts. There are always with us the doubting ones, and it is for these that trial performances are resorted to. The Commonwealth Edison Company is not only willing, but is anxious to furnish whenever possible trucks for trial purposes, during which costs are carefully kept as to battery charging. Garaging, insurance, the tires and lubricants, and so on, are definite charges, energy and battery charges being the variables. It is, however, the cost per mile that interests the prospective purchaser. In nine cases out of ten these trial performances, which may be continued for some little time, are convincing. Lower operating costs invariably accrue. Often the purchaser finds the time of deliveries is reduced, and this is, of course. particularly the case when it is a matter of supplanting horse-drawn vehicles. In passing it might be mentioned that although the gasoline truck has, on the average, a higher speed than the electric, it does not always show the shorter time for deliveries. The electric truck has far more rapid rates of acceleration, and this fact alone often enables the electric to make better time where frequent slowing down and starting again occur as for door to door deliveries and through congested streets—a condition that also costs far less in wear and tear and fuel with the electric than with the gasoline truck.

It has often happened that one of these trials results in the prospect obtaining an electric to try out, which means that the fleet of gas trucks will be eventually replaced by electrics. The trial performance is unequalled for interesting and converting those that doubt the operating costs claimed, and always emphasizes other advantages such as cleanliness, silence, absence of odor, general efficiency, and sustained uniform performance.

There are various ways of making a sale of anything. One is on talking points, another is on prophesies, another on guarantees. But there is only one way of making a repeat sale, however, and that is on satisfactory performance. This being the case, it is reasonable to suppose that the repeat order represents a satisfied customer. The electric trucks sold in Chicago are being sold because it is possible to show them a good investment. They are being sold because they do things better and cheaper than some other forms of truck will do them. Electric trucks in Chicago are going over the top because a wide-awake central-station company is co-operating with electric truck manufacturers, both, in turn, realizing that never was time more favorable to the electric than today.

ELECTRICS PROGRESSING IN ENGLAND.

Although the development and use of electric vehicles was comparatively slow in England prior to the war, the electrics have been given a big boost since 1914 because of the great need for gasoline for military trucks and airplanes. Commercial electrics have consequently come into considerable use.

QUESTIONS AND ANSWERS

All readers are invited to submit questions and answers to this department. Anonymous communications will not be considered. Questions should relate to electrical matters of any kind. Answers contributed by readers should be submitted preferably within eight days of the date of publication of the question and should be limited, if possible, to 300 words. Payment will be made for all answers published.

Questions.

No. 420.—Time Studies in Electrical Construction.—I would like to inquire whether any of your readers ever have made, or know of any one having made, a time study of the labor elements of installing conduit, boxes, etc., for electric wiring. If so, from whom and in what form are these data available?—R. M. E., St. Paul, Minn.

No. 422.—Motor-Starting Trouble.—A plant supplying a small town with power and light contains the following equipment: Two 37½-horsepower high-speed engines, running 350 revolutions per minute and driving two belt-driven 20-kilowatt, 60-cycle, 2300-volt, 1800 revolutions per minute generators. Two exciters belted to the generators give 90 volts. The switchboard is equipped with voltmeters, ammeters, rheostats, but no regulators for the machines, voltage regulation being done by hand. Primary lines are of No. 8 copper. At about 500 feet from the power house the first transformer of a bank of three 7½-kilowatt units connected closed delta is taken off; they supply 220-volt power to an elevator motor 1000 feet distant from the power house. The next transformer is 150 feet farther on toward the elevator and the last one in the bank is 250 feet from the elevator. Secondary lines are No. 8 copper clear to the motor. The motor is 5-horsepower squirrel cage with no starting device. When attempt is made to start the motor without load and with no friction on bearings it pulls the line voltage down from 220 to around 100 volts and holds at this point for about three seconds when it begins to build up, and at the end of ten seconds returns to 220. The motor will then be running. It not only pulls down the secondary voltage but also the primary voltage so that the entire system is effected. The engine also shows an appreciable decrease in speed, but as no proper speed indicator is available, it is impossible to tell how great is this drop in speed. The engine flywheels weigh about 250 pounds each and we surmised that they are so light as to be unable to withstand the sudden jar of the motor being thrown on. The motor will pull 5 horsepower when up to speed but will not start itself. We do not know where the trouble is located, on the line, in the power house or at the motor?—B. A., Watertown, S. D.

No. 423.—Iron Bars for Bus Bars.—An order was received for a new switchboard containing voltmeter, ammeter, main switch (fused for 400 amperes), ground lamps, pilot lights and four circuit switches. Being unable to obtain copper for the bus bars, flat iron was used, having seven times the cross section of the intended copper, with joints scraped and bolted together. The board was inspected and passed by the local inspector under Rule 2, section *b*, second paragraph, of the 1915 Code.

Several weeks later this same inspector called and stated his office claimed all bus bars must be of pure copper, and that the inspection department would not approve a substitute that might start a bad practice among contractors and switchboard builders. Reference was made to rules 18, 49 and 57. In none of these rules is it stated that conductors must be made of copper, only in Rule 18 it shows the carrying capacity of wires and cables of 98 per cent conductivity.

The firm using this switchboard is working on special war orders for the government and if unable to get a ready-made board or copper bus bars must shut down or pay hazardous insurance rates. I would appreciate opinions from some authority on this subject, as it has been impossible to obtain satisfaction from the electrical engineer of the underwriters.—L. G. Dubois, Pa.

No. 424.—Lightning Rods for Farms.—In advancing the well-known reasons for rodding farm, barns and similar exposed rural structures, what actual data are available as showing conclusively the wisdom or necessity of installing lightning arresters? What data are there showing the actual reduction of lightning and fire losses due directly to rodding buildings?—M. G. McG., Fargo, N. D.

No. 425.—Copper-Covered Wire for Naval Use.—Is copper-covered wire used upon ships, in the navy especially, for electrical purposes where strength is required, such as for antennae of wireless outfits? The writer has heard it stated that copper-covered wire is unable to stand up in salt-laden atmospheres, and where corrosive fumes from the stacks of battleships have to be withstood. Is this correct, and what metal supplants copper for this class of service?—P. M. C., San Francisco, Cal.

Answer.

No. 421.—Wiring for Farm-Lighting Plants.—Where the common 32-volt farm-lighting plants are installed, is the wiring usually done by a reputable electrical contractor from the nearest town, or by the farmer himself? Is it customary for the manufacturers of such plants to recommend first-class wiring of the premises by a competent contractor; do they give suggestions as to how the wiring should be done, or do they treat it as a matter of no concern of theirs or even minimize its importance, thus giving the impression that practically anything will do?—T. H. R., Guthrie, Okla.

Why should not the electrical wiring of a farm home receive the same careful attention that a house in town receives? And yet they do not, at least not in my locality. The usual procedure is for the farmer to buy his plant and then call on any one who professes to know how, to wire his buildings. The result is that nine cases out of ten they are wired with no thought of drop, and on the same plan as where a voltage of 110 is available. Flatiron and heater openings are wired with No. 14 wire and the entire house is usually put on one circuit. I have even seen the entire house all on one circuit of No. 14 and the same circuit carrying the lines for the outbuildings some 300 feet away. Consequently when the farmer installs his iron or his motor, they will not give satisfaction. The trouble is usually easy to find but hard to remedy and get a neat job, especially if the house was wired when built. But the substitution of a heavier wire usually turns the trick.

As nearly as I have been able to determine, the manufacturers give little or no thought as to how the farmer will wire his buildings and the farmer is left to pick his own course. Looking at it from a farmer's point of view, it is easy to see why he lets the cheapest man have the job. He is inexperienced in electrical matters and does not see the necessity of using such a heavy wire as is required when it runs up the expense so much. He thinks, "If it works in town why will it not work here." If you set out to convince him that he needs the heavier job he usually thinks the salesman is working for an extra profit. Or else you must do your best to educate him in the electrical reason why. This is usually hard to do. On the other hand, it is easy for him to see that it is costing him a good third more to have his house wired than it is for his brother in town.

The manufacturer should take this up in this literature and seek to impress on the farmer's mind that it is absolutely necessary for the farmer to have his buildings wired properly. Otherwise the manufacturer will often be blamed where it is not due him. I have had experience on plants where appliances have failed to work properly and the cause was usually found to be that too small a wire was being used for too great a distance. In one case it even affected the plant to a point where the battery could not be charged properly. In this case the plant was heartily condemned, but after a heavier wire was substituted for the small wire praise took the place of condemnation.—C. K. B., Watertown, S. D.

New Appliances

Haag Electric Washer—Portable X-Ray Field Outfit—Linemen's Grip and Pliers—Compensarc for Projection Use

HAAG STAVE-LEG MODEL ELECTRIC WASHER.

Efficiency, simplicity and durability may be set forth as the important features any washing machine should possess. The value of these features is self-evident to any discriminating user of washing machines. Of makers of washers who have given special consideration to these points is the well known firm of Haag Brothers Company, Peoria, Ill. Every detail

Haag "Supreme" Electric Washer.

of the Haag machines has been studied out to make them efficient, simple and durable in construction.

The Haag machine, illustrated herewith, is known as the "Supreme" washer. It is of unusually sturdy build and compact design, suitable for use in the kitchen or small laundry. The legs are a continuation of the staves of the tub, which eliminates loose or wobbly legs where an ordinary outfit is subjected to rough usage. This machine provides for underneath drive with both motor and drive wheel entirely under the tub, out of the way, and guarded. The tub is of extra heavy stock and provided with corrugations on its inner surface, acting as a washboard. Two interchangeable washing devices are provided, the one shown at the right being a flat dasher for rubbing delicate fabrics, laces, etc., while the dolly shown in the foreground is used for general washing of heavier goods. The wringer can be swung to any of four positions so that clothes can be wrung out of two sides of the tub, and from rinsing to bluing tubs or to the clothes basket. The wringer has a two-handled reversing or stopping lever accessible from either side of the wringer; this lever is itself a safety device in addition to the safety release provided on the wringer. An extra tub rack can be furnished for this machine.

Two other models of electric washers are built by the Haag Brothers Company. These are bench-type machines, with either a short or long bench on which additional tubs or baskets can be placed. An additional pulley can be provided by means of which an ice-cream freezer or other device can be driven from the washer.

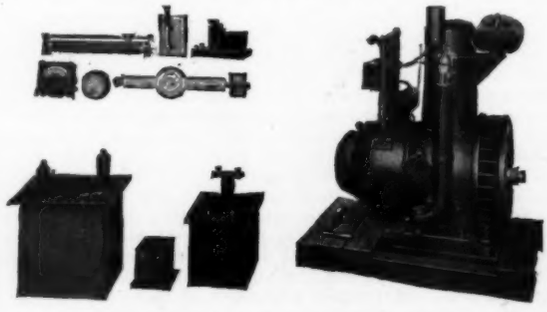
A PORTABLE X-RAY SET FOR FIELD SERVICE.

During 1917 the Research Laboratory of the General Electric Company made some experiments and developments in X-ray apparatus of interest to the medical and surgical professions.

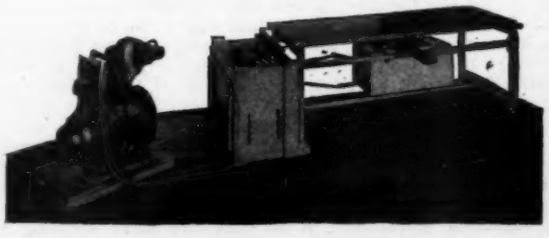
The concrete result of these efforts was a portable X-ray outfit, designed so that troops in active service at a distance from base hospitals might have the benefits of X-ray examination promptly available.

This was accomplished by a process of elimination through a series of tests which resulted in the final assembly of the most suitable products of several manufacturers which are used in connection with the Coolidge tube. Particular care was taken to pick out those elements which were in actual production and available for immediate use.

The equipment consists of a single-cylinder, air-cooled gasoline engine, direct-connected to a one-kilowatt direct-current generator, provided with slip rings, a main X-ray transformer, a filament transformer for lighting the filament of the Coolidge tube, a voltmeter and milliammeter, the necessary controls and switches, and a special radiator type of Coolidge tube, capable of rectifying its own current. Variation of X-ray output is obtained by variations of engine speed. The carburetor of the engine is controlled through a sole-



Parts of the X-Ray Set for Field Service, Showing Control Equipment, Instruments, Coolidge Tube, Transformers, and Engine-Driven Generator.



Portable X-Ray Field Outfit Complete and Ready for Service.

noid and the necessary changes in speed are effected by means of a simple resistance unit, located at the head of the operating table when the outfit is being used.

For radiographic work the set will deliver 10 milliamperes at a voltage corresponding to a spark of 5 inches between points. For fluoroscopic work the current is reduced to 5 milliamperes, the voltage remaining the same.

Due to the rectification characteristics of the Coolidge tube no separate rectifier is required. The entire equipment, including the operating table, can be rapidly assembled or disassembled for transportation, the complete set having a net weight of about 860 pounds.

While sets for similar service have been developed in Europe, under the spur of urgent need, the equipment here referred to constitutes the first American portable X-ray outfit of this capacity.

NEW LINEMEN'S TOOLS.

The work of the lineman is so strenuous that anything that will help to make it easier and less hazardous is of interest. In this line is a set of tools which the Smith & Hemenway Company, Inc., 261 Broadway, New York City, has recently added to its well-known line of "Red Devil" tools.

In the accompanying illustration is shown an improved Red Devil Buffalo grip. This is exactly the same style as the regular Buffalo grip, except that it is so arranged that when it is open to receive the wire it locks, and will not loosen until the handle is turned down. This grip is made of a very hard drawn steel and riveted with tool-steel rivets. It has found considerable favor with the trade and is used by telephone, telegraph and electric light and power companies for all sorts of wires. It is also made with pulleys as well as with loops on the end.

The improved Red Devil Havens grip is made of drop-forged steel, the loop being forged in the tool and not bent over as it is in all styles of grips of this character heretofore made. It is forged from high-carbon steel and is made to stand a straining test of more than four times the weight ordinarily exerted on it. It will stretch all kinds of wire, either iron, steel, copper or brass, and is used in the construction of electric light, telephone and telegraph lines, being made in different sizes to receive wires from ⅛ up to ½ inch.

Red Devil Buffalo Grip.

The loop in this tool being forged in, makes it a physical impossibility to break it.

Another new tool is an extra heavy electrician's plier for high-tension work. The handles have high-grade insulation tested to withstand 10,000 volts. The insulation is ⅛-inch thick and will not deteriorate with age. The pliers can be dropped from the pole without crack or injury of any sort to the insulation, according to the statement of the manufacturers, who offer this plier to the public with the greatest confidence that it will fill the most exacting requirements

Red Devil Insulated Pliers.

required by electrical companies for safety of their workmen. Each plier is tested and sealed by the Electrical Testing Laboratories, of New York City, before being shipped, and bears the date of the test. This is a new article in the Red Devil tool line, but one that will doubtless find large favor.

COMPENSARC FOR MAZDA PROJECTION LAMPS.

A new Compensarc has recently been developed by the Fort Wayne Works of the General Electric Company to control the current for the new Mazda picture-projection lamps that have just been put on the market. These lamps are intended for operation at 20 to 30 volts; the line voltage must consequently be reduced. The lamp current must also be kept constant. In order that the projection with these new lamps shall attain the highest efficiency and economy, a current-control device must be used with the lamps. This new Compensarc, known as the type I, has been developed in conjunction with the lamps so that this Compensarc and the Mazda lamp form a complete working unit capable of giving the utmost in light and lamp life. The Compensarc reduces the voltage and keeps the current constant.

The new Compensarc is a self-contained device requiring no auxiliary attachments and is rated at 750 watts, 110 or 220 volts primary and 20 or 30 volts secondary. It is compactly arranged in a sheet-metal case 20 inches long, 9 inches wide and 6 inches deep, arranged for wall mounting at a point convenient to the projection-machine operator. The working parts consist of a compensator, starting switch, rheostat and ammeter. The starting switch, rheostat handle and ammeter all appear on the face of the cabinet panel where they are handy to the operator. The starting switch on starting up the lamp automatically puts some resistance in the lamp circuit so that excessive rush of current through the cold lamp filament is prevented. The finer adjustments of current through the lamp are controlled at the will of the operator by means of the rheostat handle, the rheostat with its very fine adjustments being placed in the primary circuit. The ammeter indicates at all times the current passing through the lamp and the rheostat enables the operator to make any necessary adjustments to compensate for the slight variations in the commercial line voltage and maintain the lamp current constant.

The field of application of this projection equipment is the medium and smaller sized motion-picture theaters, and the lecture halls in colleges, clubs and military camps where the stereopticon or motion-picture machine may be used for educational and instructional purposes. The simplicity of operation of the equipment, the low investment and operating costs and the excellence of the projection obtainable are strong factors in its favor.

Pass & Seymour, Inc., Solvay, N. Y., has placed on the market a pull canopy switch, which combines in one the ordinary fixture canopy and the adjoining ceiling switch. It is especially suited for pendent and drop cord work, is easily wired, and includes a special cord grip, making it a very strong device.

Current News

Weekly Record of Construction Activities—Conventions

EASTERN STATES.

RUTLAND, VT.—Rutland Railway, Light & Power Company during the past week has connected 17½ horsepower in motors to the lines of this system.

BOSTON, MASS.—New York, New Haven & Hartford Railroad Company, New Haven, Conn., has recently awarded a contract to C. W. Murdock, 185 Church street, New Haven, for the construction of a one-story electric battery building, about 20x140 feet, at Dover, near Boston.

ALBANY, N. Y.—Havens Electric Company, manufacturer of electrical supplies, has recently increased its capital from $25,000 to $100,000. Notice has been filed with the Public Service Commission.

BROOKLYN, N. Y.—Edison Electric Company, 360 Pearl street, has had plans prepared for alterations and improvements in its one-story brick power house on Gold street. G. L. Knight, 13 Willoughby street, Brooklyn, is architect.

BROOKLYN, N. Y.—The United States Government, Bureau of Yards & Docks, has awarded a contract to the Westinghouse-Church-Kerr Company, 37 Wall street, New York, for the construction of a one-story steel power plant building, about 48x80 feet in size, at the local navy yards. C. W. Parks is chief.

BROOKLYN, N. Y.—Kings County Electric Light & Power Company, 360 Pearl street, has made application to the Public Service Commission for permission to issue bonds to the amount of $1,000,000, to provide for extensions, improvements, etc.

DUNKIRK, N. Y.—The city will install a modern street lighting system in the business section this summer. Post lights will be used instead of street arches. An appropriation of $5000 will be put into the new budget for the purpose.

BUFFALO, N. Y.—The City Council has recently completed improvements and alterations in its street-lighting system on Main street, Hertel avenue, Fillmore avenue, and Lovejoy street.

NEW YORK, N. Y.—Astra Electric Novelty Works, 152 Wooster street, have leased the second floor of the building now occupied by the company, to provide for increased capacity.

NEW YORK, N. Y.—Edison Storage Battery Company is planning for the construction of a three-story brick and stone building, about 60x100 feet in size, at 247-51 West Thirty-fifth street.

NEW YORK, N. Y.—The Public Service Commission has just leased the second floor of the building at 241 East Fourteenth street, to be used as an office in connection with the construction of the new Fourteenth street subway.

BAYONNE, N. J.—East Jersey Railroad & Terminal Company has been granted approval by the Board of Public Utility Commissioners on its application for permission to issue stock to the amount of $357,000, to provide for improvements, etc.

BORDENTOWN, N. J.—The board of commissioners is considering the installation of new electric lighting fixtures throughout the City Hall building.

CHATHAM, N. J.—The common council has approved the recommendation of the Board of Works for an increase of 20 per cent for electric power service, due to the advanced cost of operating the municipal plant.

MOUNTAIN LAKES, N. J.—State Board of Education has issued notice to the Hanover Township Board of Education providing for the installation of a new heating system in the local school buildings.

NEWARK, N. J.—The United States Shipping Board has had plans prepared for the extension of the tracks and through train service from the Hudson & Manhattan Railroad Company, to provide transportation facilities for workers in the shipyards and other war plants at Port Newark Terminal. Plans were prepared by A. L. Drum, transportation engineer of the shipping board.

NEWARK, N. J.—Effective April 1, the Public Service Railway Company has placed into operation the "skip stop" schedule for its traction lines in the Essex division. It is estimated that the new schedule will result in a saving of approximately 25,000 tons of fuel annually.

NEWARK, N. J.—Warren C. King, Bound Brook, president of the Manufacturers' Council of New Jersey, has made announcement that legal aid will be engaged in endeavoring to compel the Public Service Corporation to restore its power contracts recently abrogated. It is held by the council that this abrogation is illegal.

NEWARK, N. J.—New York Telephone Company has recently awarded a contract to W. A. L'Hommedieu, 1 Madison avenue, New York, for alterations and improvements in its telephone building on Market Exchange.

PAULSBORO, N. J.—Borough council has completed the installation of a new electric fire alarm system.

TRENTON, N. J.—Crescent Insulation Fire & Cable Company is having plans prepared for the construction of a three-story reinforced concrete factory building, about 85x100 feet in size.

CLIFTON HEIGHTS, PA.—Kent Manufacturing Company has recently awarded a contract for the construction of its proposed one-story power house, about 45x60 feet. D. J. McNamee, Philadelphia, is the contractor.

EAST BRADFORD, PA.—Kendall Refining Company has recently awarded a contract for the construction of a two-story brick addition to its boiler plant, about 40x75 feet in size.

KITTANNING, PA.—Triple Airless Tire Company, Pittsburgh, Pa., has had plans prepared for the construction of a one-story power plant, about 40x80 feet, in connection with the erection of a large new rubber plant, the entire work being estimated to cost $85,000. Herbert & Henderson, Kittanning, are architects.

MAUCH CHUNK, PA.—Carbon County Transit Company has filed petitions with the Town Councils of Mauch Chunk, East Mauch Chunk, and Lehighton, for permission to increase its traction fares from five to seven cents. The advance is asked on the basis of the increased cost of operation, etc.

PARKESBURG, PA.—Parkesburg Iron Company has awarded a contract for the construction of a one-story addition to its boiler plant, about 30x41 feet. The Rust Engineering Company, Penn building, Philadelphia, is the contractor.

PHILADELPHIA, PA.—Atlantic Refining Company, 3144 Passyunk avenue, has taken out a permit for alterations and improvements in its power house at Thirtieth and Race streets, to cost about $11,300. Contract has been awarded to Metzger & Fisher, Otis building.

PHILADELPHIA, PA.—Bell Telephone Company has taken out a building permit for the construction of a one-story brick building at 5154 Lancaster avenue.

PHILADELPHIA, PA. — James F. Burns, 715 Cherry street, manufacturer of electrical specialties, is having plans prepared for the construction of a five-story brick addition to his plant. John V. Speth & Company, 1627 Sansom street, are architects.

PHILADELPHIA, PA.—Electric Service Supply Company, Seventeenth and Cambria streets, manufacturer of electrical supplies, has awarded a contract for alterations and improvements in its plant. John N. Gill Company, Otis building, is the contractor.

PHILADELPHIA, PA. — Fritz Company, East Ontario and Brabant streets, has filed plans for the construction of a new engine and boiler house addition to its plant, about 35x45 feet, and 22x37 feet, respectively, to cost about $15,000. H. Brockelhurst, 512 West Norris street, Philadelphia, is the contractor.

PHILADELPHIA, PA. — Philadelphia Storage Battery Company has awarded a contract to Stewart Brothers, 2526 Orkney street, Philadelphia, for the construction of a one-story addition, about 40x100 feet, at C and Ontario streets.

FORT DU PONT, DEL.—The United States government has had plans prepared for the construction of a local one-story brick radio station, about 18x23 feet in size.

LINTHICUM, MD.—Consolidated Gas, Electric Light & Power Company, Lexington Street building, Baltimore, has awarded a contract to the Coggswell-Koether Company, 406 Park avenue, Baltimore, for the construction of its proposed one-story power station, about 26x40 feet in size.

MYERSVILLE, MD.—The city is planning for the early establishment of a new local electric lighting plant and waterworks.

WASHINGTON, D. C.—The council is arranging to improve the lighting on 14th street, Columbia Heights. Address city electrician.

CHARLOTTE, N. C.—Charlotte Electric Repair Company has recently awarded a contract to R. L. Good, Charlotte, for the erection of an addition to its plant to cost about $5000.

CHARLOTTE, N. C.—Southern Public Utilities Company is planning for improvements in its plant and system to provide for increased capacity.

MORGANTOWN, N. C. — Southern Power Company is said to be considering the construction of a local hydroelectric plant on the Johns river, requiring the construction of two dams.

PINE LEVEL, N. C.—Citizens' Power & Light Company is considering plans for the construction of a 13-mile transmission system, connecting various towns, and the erection of two new substations.

REIDSVILLE, N. C.—The city officials have authorized a bond issue of $10,000 to provide for the installation of an electric lighting plant.

CHARLESTON, S. C.—Charleston Consolidated Railway & Lighting Company is planning for the installation of a new turbine at its power house in connection with other improvements, to provide for increased capacity.

SUMTER, S. C.—The city is considering plans for the immediate installation of a new electric lighting plant.

DALLAS, GA.—Dallas Utility Company, recently incorporated, is planning for the immediate installation of an electric power plant on Pumpkin Vine Creek, Paulding County, to have a capacity of 250 horsepower and a five-mile transmission system. J. S. Boggs is manager.

MACON, GA.—Macon Gas Company has awarded a contract for the construction of an addition to its gas works, to provide an increased capacity of 10,000,000 cubic feet of gas per month. Estimated cost of the structure is $40,000.

JEFFERSONVILLE, GA.—The city has voted $15,000 in bonds for the building of waterworks and $6000 in bonds for building an electric light plant. Address the mayor.

NORTH CENTRAL STATES.

BRYAN, OHIO.—The sum of $40,000 will be expended in improving the electric light and water system. Address village clerk.

CLEVELAND, OHIO.—The city engineer of the building department has prepared plans for a $256,000 electric light plant. The building will be 169x175 feet in size, three stories high. Generators, dynamos, etc., will be installed. Contracts will be let by the city.

HOLGATE, OHIO.—Pleasant Light & Water Company was recently organized with a capital of $10,000 to take over the municipal electric light and water plant. Additional equipment will be purchased. Address William Pepper.

LORAIN, OHIO.—American Ship Building Company is building a $200,000 power house, which will be one of the finest in the country. The power plant is included with the new boiler shop, machine shop and other new departments that are provided by the company's big expansion plan.

MANSFIELD, OHIO.—Richland Public Service Company has increased its capital from $10,000 to $3,200,000.

SANDUSKY, OHIO.—Sandusky Gas & Electric Company has closed a contract with the Erie Window Glass Company for an initial installation of electric power, which will eventually lead to a larger power demand.

SAVANNAH, OHIO. — The electric plant was recently destroyed by fire. Address village clerk.

SPRINGFIELD, OHIO. — Springfield Light, Heat & Power Company has petitioned the State Utility Commission for authority to issue $100,000 in bonds to purchase boilers and mechanical equipments and extend mains and service. Address C. I. Weaver, general manager.

CHARLESTON, ILL.—Coles County Telephone Company and the Ashmore Mutual Telephone Company have filed a joint petition with the Illinois Public Utilities Commission for an authorization enabling the Coles County Telephone Company to purchase the plant of the Ashmore Mutual Telephone Company.

EAST ST. LOUIS, ILL.—The capital stock of the East St. Louis Light & Power Company has been increased from $1,100,000 to $1,200,000.

PERRY, ILL.—Perry Light & Power Company has filed a petition with the Illinois Public Utilities Commission to discontinue business on the grounds that the plant is not making expenses.

SPRINGFIELD, ILL. — Springfield Plow Company will build a new warehouse, brick, four stories, $35,000, complete, with lighting apparatus and sprinkler system.

SPRINGFIELD, ILL.—Tentative plans have been drawn for the new Centennial building to be erected on the plot of ground just south of the State Capitol. The plans will be soon reviewed by the Centennial Building Commission. The best methods of illumination and electric wiring will be installed.

SPRINGFIELD, ILL.—The Illinois Public Utilities Commission is moving the commercial offices back into the DeWitt Smith building, which structure the commission occupies in part and which was gutted by fire a few weeks ago. At the time of the fire it was feared that many valuable records of the commission would be lost or ruined, but these losses have been reduced to a minimum.

BUTTERNUT, WIS.—Butternut Electric Light & Power Company plans the installation of an additional three-wire generator of a 15-kilowatt capacity and a kerosene oil engine. W. J. Schultz, manager.

NEENAH, WIS.—The city council is considering the purchase of electrical equipment for the city stone quarry. Address the city clerk.

PINE CITY, MINN.—Eastern Minnesota Power Company contemplates making some improvements, consisting of the installation of a 500-kilowatt steam turbine and also the building of 10 miles of transmission lines.

MANKATO, MINN.—The city has under consideration the erection of a municipal light and power plant and a committee has been named to investigate the proposition.

DATES AHEAD.

Tri-State Water and Light Association. Annual meeting, Charlotte, N. C., April, 1918. Secretary-Treasurer, W. F. Steiglitz, Columbia, S. C.

Southwestern Electrical and Gas Association. Annual convention, Galvez Hotel, Galveston, Tex., April 15-16. Secretary, H. S. Cooper, 405 Slaughter building, Dallas, Texas.

American Association of Engineers. Annual meeting, May 14, 1918. Secretary-Treasurer, A. H. Krom, 29 South La Salle street, Chicago.

Arkansas Association of Public Utility Operation. Annual convention, Arlington Hotel, Hot Springs, Ark., May 21-22-23. Secretary-Treasurer, R. B. Fowles, Pine Bluff, Ark.

Electrical Supply Jobbers' Association. Annual meeting, Homestead Hotel, Hot Springs, Va., May 28-30. Secretary, Franklin Overbaugh, 411 South Clinton street, Chicago.

Electrical Contractors Association of Georgia. Annual meeting, Tybee Island, Ga., June, 1918. Secretary, Dan Carey, 614 Chamber of Commerce building, Atlanta, Ga.

National Electrical Credit Association. Annual meeting, June 1, 1918. Secretary, Frederick P. Vose, 1350 Marquette building, Chicago, Ill.

American Society of Mechanical Engineers. Spring meeting, Worcester, Mass., June 4-7. Secretary, Calvin W. Rice, 29 West 39th street, New York City.

Texas State Association of Electrical Contractors. Annual meeting, Galveston, Tex., June 15, 1918. Secretary, H. S. Ashley, Fort Worth, Tex.

Southeastern Section, National Electric Light Association. Annual meeting, June 19-20, 1918. Atlanta, Ga. Secretary-Treasurer, T. W. Peters, Columbus, Ga.

American Institute of Chemical Engineers. Summer meeting, Berlin, N. H., June 19-22. Headquarters, Mt. Madison House, Gorham, N. H. Secretary, John C. Olsen, Brooklyn, N. Y.

Northwest Electric Light and Power Association; affiliated with N. E. L. A. Annual meeting, September 11, 1918. Secretary, George L. Myers, Pacific Power & Light Company, Portland, Ore.

MINNEAPOLIS, MINN.—Northwestern Telephone Company will erect a 12-story telephone building. W. B. T. Belt, general manager.

TOMMALD, MINN.—The city has under consideration the installation of an electric lighting system. Address the town clerk.

KANSAS CITY, MO.—The Kansas City plant of the Western Electric Company was slightly damaged in the large fire which burned several blocks in the West Bottoms wholesale district. The plant of the American Steel & Wire Company was completely destroyed in this fire.

KANSAS CITY, MO.—Kewanee Boiler Company, 1420 McGee street, is in the market for hand-power or electrically-driven traveling crane on track, similar to locomotive type, with a capacity of 20,000 pounds.

ST. LOUIS, MO.—Southwestern Telephone & Telegraph Company has had plans prepared for the construction of an addition to its telephone exchange plant. Estimated cost of the structure is $9000. Contract has been awarded to Murch Brothers, St. Louis.

BROOKVILLE, KANS.—Election was held recently to vote on the issuance of $3000 bonds for the purpose of contracting for and furnishing electric current for the lighting of the streets and public places and furnishing electric light for inhabitants of the city. J. E. Wallace, city clerk.

DIGHTON, KANS.—Election to vote $15,000 bonds, for the purpose of furnishing the inhabitants of Dighton with water and electric lights and to make such extensions as may be necessary, carried.

DOWNS, KANS. — United Telephone Company, of Abilene, will erect a $15,000 telephone building here. Address J. L. Brown, manager, Abilene.

GARDEN CITY, KANS.—The Public Utilities Commission has been taking testimony in a case wherein the Sugar Beet Syndicate, which furnishes electrical power to the city and to the farmers for irrigation purposes, is seeking to increase its rates and change its hours of service. The power company seeks to put into effect a system of rotating power in zones or districts similar to the plan on ditch companies in rotating water to consumers. In this way the company would deliver electrical power in alternate weeks to the consumer. The plan is being vigorously opposed by the farmers.

LEONARDVILLE, KANS. — Riverside Light & Power Company will soon furnish electric current for light and power to Leonardville. A complete street lighting system with 20 lights will be installed and doubtless a White Way will follow.

PERU, KANS.—An electric light plant is to be established here.

STOCKTON, KANS. — Arrangements have been made whereby the United Telephone Company purchased the Webster Central Company and as soon as the work can be accomplished some twenty or more lines will be run out from Stockton and the Webster line still be attached to this point.

WINCHESTER, KANS.—The Automatic Electric Light Company of Kansas City will install an electric light and power plant near Winchester.

CARROLL, NEB.—The proposition of issuing $9500 bonds for a lighting system carried at the election.

LINCOLN, NEB.—R. C. Stake has been awarded the contract for the erection of a power house at the penitentiary to cost $13,380. Address clerk of the State Board of Control.

SOUTH CENTRAL STATES.

NORTONVILLE, KY.—Contract for the erection of its proposed addition to the central power plant, has been awarded by the Norton Coal Mining Company to the Ruby Lumber Company, Madisonville, Ky.

CHATTANOOGA, TENN.—Cumberland Telephone Company has acquired additional space in the Temple Court building, and is planning for the installation of a number of switchboards.

BIRMINGHAM, ALA.—Tennessee Coal, Iron & Railroad Company has made announcement that extensive improvements will be made in its No. 1 power station at the Ensley blast furnaces, including the installation of a 7500-kilowatt turbo-generator.

MOBILE, ALA.—Muran Shipbuilding Company will enlarge its shipyards, also its electric light plant. Address general manager.

SELMA, ALA.—Selma Traction Company will make extensive improvements to its plant. Address J. D. Woodard, president, Warren, Pa.

CRYSTAL SPRINGS, MISS.—Bonds to the amount of $5000 will be issued for the installation of new equipment in the electric light plant. Address the mayor.

SULPHUR, LA.—The telephone company's property was damaged recently in a fire by the burning of poles and about 300 or 400 feet of its cable.

ADA, OKLA.—The power plant of the Oklahoma Power & Transmission Company is now making current for Francis, Maud, Kenawa, Shawnee, Seminole and Tecumsah. Stonewall has asked for power and will be supplied.

BLACKWELL, OKLA.—The city has authorized a bond issue for $82,500 for extensions, improvements, etc., in its electric lighting system.

POTEAU, OKLA.—A movement is under way to build a new electric light plant in Poteau. A franchise will be asked next month.

DALLAS, TEX.—Dallas Electric Light & Power Company, which, when it accepted its new franchise recently agreed to make $2,000,000 worth of improvements to its properties in this city, has already submitted to the Supervisor of Public Utilities for his approval requisitions amounting to $2,800,000. M. E. Baker, supervisor of public utilities, announced recently that $177,365 will be

expended to build a new substation in Oak Cliff and the connecting of the substation with the main power station and a downtown substation.

DALLAS, TEX.—Dalhart is planning modern methods of street lighting, using the iron posts with a cluster of lights at the top.

DALLAS, TEX.—The city commission, upon request of C. W. Hobson, representing the Dallas Railway Company, has rescinded the contract by which that company was required to construct two interurban electric lines into Dallas. Mr. Hobson presented a statement showing that the increased cost of material would prohibit it, and that the proposed lines could not be constructed at this time. One of the roads was to run to Terrell, about 30 miles, and the other to Denton, about 30 miles.

WESTERN STATES.

MANNVILLE, WYO.—The city authorities of Mannville propose to expend $20,000 on a new lighting system.

CLOVIS, N. M.—The sum of $25,000 has been voted for electrical improvements.

CHEHALIS, WASH.—The question of granting a franchise to O. E. Anderson and others for erection of a power plant here is to be voted on April 20.

MONDOVI, WASH.—Washington Water Power Company has been granted a permit by the county commissioners to install electric lights here in the spring.

SEATTLE, WASH. — The state of Washington has purchased bonds in the sum of $350,000 voted at the last election by the city for constructing a municipal elevated electric railway line to the shipyards.

SEATTLE, WASH.—It is understood that City Engineer A. H. Dimock and Superintendent of Lighting J. D. Ross will recommend to the board of public works the award of a contract to Grant Smith & Company for a completed power plant on the Skagit river, largely of timber construction, at a cost of $2,381,000. The acceptance of this offer will obligate the city to market utility bonds in order that payments may be made in cash, a stipulation of the bid, and before the bonds are offered it will be necessary for the city to submit the proposal to the capital issues committee of the federal reserve board for approval in order that outside capital may be attracted to the securities.

TACOMA, WASH.—The voters of the city have defeated the proposition of bonding in the sum of approximately $5,000,000 for the purpose of purchasing the street railway system of the Tacoma Railway & Power Company.

TACOMA, WASH.—The ordinance for the issuance of $4,000,000 in bonds by which the city of Tacoma will procure a power house for the city electrical system has been sent to the city council from the committee room recommended for passage and will come up for passage before the people on April 16.

COTTAGE GROVE, ORE.—Cottage Grove Electric Company is installing machinery which will more than double the present capacity of the plant.

HELIX, ORE.—Contract has been awarded to John Vaughan of Pendleton for wiring for installation of electric lights and power for the mill of the Helix Mill Company at this place.

MARSHFIELD, ORE.—The Umpqua Light & Power Company, which has taken over the Gardiner Light & Power Company, is preparing for the installation of a new 125-horsepower steam engine in place of the 40-horsepower gasoline engine and is making preliminary arrangements for installing a power line across the Umpqua river at Reedsport.

PORTLAND, ORE. — Electric Steel Foundry Company, 24th and York streets, has a permit to erect a transformer house. Northwestern Electric Company, Pittock building, has received permit to erect foundation and walls for the boiler room at the foot of Lincoln street. Charles C. Moore & Company, engineers.

VISALIA, CAL.—Mt. Whitney Power & Electric Company has applied to the State Railroad Commission for confirmation of a new form of contract whereby new patrons will pay a portion of the cost of installing new service lines.

FOREIGN TRADE

[Addresses of firms referred to in these trade opportunities may be obtained by writing to the Bureau of Foreign and Domestic Commerce, Washington, D. C., or its branch and local co-operative offices. Request for each opportunity should be on a separate sheet and the file number given.]

ELECTRIC LAMPS AND ACCESSORIES (26,733).—A merchant in India desires to be placed in communication with American manufacturers and exporters of chemicals, cutlery, electric lamp and accessories and other articles. Direct inquiries will be received by the Bureau.

ELECTRICAL APPARATUS (No. 26,716).—A firm in Mauritius is in the market for bolts and nuts, shovels and spades, and electrical sugar-making machinery.

PROPOSALS

WIRE, CORD, GRINDING MACHINE, ETC.—Bids will be received by the Bureau of Supplies and Accounts, Navy Department, Washington, D. C., and bidders desiring to submit proposals should give schedule numbers for furnishing the following: Schedule 1723, pipe threading and cutting machines; schedule 1724, twin lamp cord, lead-covered wire, rubber-covered duplex wire, and weatherproof wire on reels; schedule 1725, plain leaded and armored interior-communication cable, plain leaded and armored double-conductor duplex wire, armored duplex double-conductor wire, plain enameled magnet wire, plain single-conductor wire, and single-conductor leaded and armored soft steel wire; and schedule 1739, motor-driven 16 inches by 8 feet selective-head type engine lathe, and motor-driven plain grinding machine.

CABLE.—Bids will be received by the West Chicago Park Commissioners of Chicago, at their offices in Union Park, until April 16 for 24,000 lineal feet of lead-covered cable. All cable must be delivered in accordance with specifications. Proposals must be made out upon forms to be obtained at the above offices addressed to the West Chicago Park Commissioners. I. Shapiro, secretary.

ELECTRICAL EQUIPMENT. — Bids will be received at the office of the Superintendent of Prisons, Department of Justice, Washington, D. C., until April 16, for furnishing and delivering at the penitentiary, Atlanta, Ga., switchboards, power tablet and electric feeders for light and power for the east main cell wing.

INCORPORATIONS

INDIANAPOLIS, IND.—Home Lighting & Storage Battery Company has incorporated with a capital of $25,000, and will engage in the manufacture of storage batteries for automobiles, etc. The incorporators are Samuel M. Denton, Luther O. Draper and Isaac E. Hays.

SAVANNAH, GA.—Chatham Traction Company has made application for its incorporation with a capital of $150,000. The new concern plans to build and operate an electric railway. Address H. C. Foss.

SEATTLE, WASH.—Leone Dual Lighting & Irrigation Company has been incorporated for $50,000 by C. P. Gorman, J. G. Brown and W. H. Angel.

WHITACRE, VA.—Whitacre Telephone Company has incorporated with a capital of $5000. W. C. Whitacre, president.

CHICAGO, ILL. — Illinois Southern Power Company has incorporated with a capital of $2500. The incorporators are Henry M. Brooks, M. E. Gillis and P. L. Miller.

POPLAR, MONT.—Speed Electric Company has incorporated to build and operate a power plant with a capital of $10,000. M. A. Erickson.

GOOD HOPE, ILL.—North McDonough Light & Power Company has been incorporated by J. E. Love, Alva H. Allison and G. H. Stopp. Capital $10,000.

MILFORD, N. H.—Articles of incorporation have been filed by the Milford Company, capitalized at $5,000,000. It is evident the concern is a hydroelectric power project, which will operate in southern New Hampshire with headquarters at Milford. The incorporators are Joseph C. Donovan, J. Edward Flynn, Elizabeth Conway, Peter J. King and Robert Upton.

IRVINE, KY.—Irvine Electric Light Company. Capital $80,000. To operate a local electric light and power plant. Incorporators: John J. Langan is the principal.

CHATTANOOGA, TENN. — Southern Cities Power Company. Capital, $50,000. To operate a plant for the generation and distribution of electricity. Incorporators: George B. Adams, J. C. Stickney, and G. W. Erwin.

DOVER, DEL.—Tirrell Manufacturing Company. Capital, $50,000. To engage in the manufacture of electric light controllers and lighting apparatus. Incorporators: F. A. Armstrong, C. L. Rimlinger, and M. M. Clancy, Wilmington.

NEW CASTLE, PA.—South New Castle Electric Company. Nominal capital, $5000. To operate a local plant for the generation and distribution of electric energy. J. C. Chestnut is the principal incorporator.

PHILADELPHIA, PA. — Philadelphia Boiler Works. Capital, $50,000. To manufacture boilers, engines, etc William Hunter is the principal incorporator.

NEW YORK, N. Y.—Belyea-Grant Electric Machinery Corporation. Capital, $5000. To engage in the manufacture of electric machinery. R. Grant, B. M. and T. S. Belyea, 48 East Eighth street, are the incorporators.

NEW YORK, N. Y.—John C. Service Company, Inc. Capital, $25,000. To engage in an electrical contracting and engineering capacity. Incorporators: J. C. Williams, A. Stemmermann and W. S. Ross, 64 Montague street, Brooklyn.

UTICA, N. Y.—Ceilite Company, Inc. Capital, $100,000. To manufacture electrical and gas fixtures, etc. Incorporators: W. I. Taber, W. L. Foley, and S. Garfunkel, Utica.

NEW PUBLICATIONS

NEW VIEWS OF THE COMBUSTION OF THE VOLATILE MATTER IN COAL is the title of Technical Paper 183, recently published by Department of the Interior. This paper, which was prepared by S. H. Katz, deals with the volatilization of the hydrocarbons in coal and the burning of the volatile matter in the combustion space of the furnace. It is one of a series of papers taking up the analysis and tests of fuels made by the Bureau of Mines to determine how fuels may be utilized most efficiently.

ANNEALING OF CARBON STEELS.—The Engineering Experiment Station of the Pennsylvania recently issued Bulletin 18 by R. B. Fehr, dealing with the "Annealing of Carbon Steels As Affected by Various Temperatures and Magnetic Flux," and tells of the investigation made with the primary object of studying the range of temperature in which the various steel treating operations should be carried out. The conclusions reached as a result of the investigation conducted, briefly stated, are that there is no perceptible effect on the physical properties of carbon steels that are annealed under the influence of a strong and constant magnetic flux; the annealing temperatures as usually recommended for carbon steels appear to be too high to confer maximum grain-refining ductility, and that the magnetic critical point on heating appears to be the proper point at which to carry out the heat-treating operations of carbon steel. Complete data concerning the method and apparatus used in conducting the tests and the results obtained are contained in the bulletin.

Trade Activities

Lake Superior Electrical Company Changes Name—Great Lakes Electric Engages Larger Quarters—Catalogs Issued

Electrical Engineers Equipment Company, designers and builders of power plant appliances, Chicago, Ill., is now distributing advanced sheets upon its Bulletin 107, which describes a new line of busbar supports.

The Great Lakes Electric Manufacturing Company has outgrown its present manufacturing facilities and has engaged much larger quarters at Lake and Jefferson streets, Chicago, Ill., where it will be located beginning May 1, 1918. G. A. Johnstone, who has had wide experience as a manufacturer of small motors, is the general manager of the Great Lakes Electric Manufacturing Company. The company will continue to manufacture as heretofore, small motors and generators for both alternating and direct current ranging in sizes from one horsepower to seven and one-half horsepower.

General Insulate Company, 1008-14 Atlantic avenue, Brooklyn, N. Y., well known moulders of "Insulate" and "Hi-Heet" specialties, some years ago since inaugurated a bonus system among its employees. This system has produced excellent results for all concerned under the energetic direction of V. C. Rockhill, general manager of the company, and has become a co-operative concern. In the future all employees of the company, both those in the factory and the field, will participate in the net earnings of the General Insulate Company. The management of this concern is to be congratulated on the foresight it has shown and the liberal manner in which it is endeavoring to compensate its co-workers.

Radle Machinery Company, Cincinnati, Ohio, dealers in and re-builders of used electrical and steam machinery, will soon celebrate its fiftieth anniversary in the business. This business has shown a marked improvement and the company has today one of the best equipped plants for the handling of power plant machinery and accessories. Every machine that enters the plant is entirely rebuilt and leaves the shop with the guarantee of the Randle company. The shop is equipped with the most modern testing apparatus and a large force of skilled workmen is available at all times. The company recently acquired a very desirable quantity of electrical machinery and will be glad to hear from those in the market for this class of apparatus.

Lake Superior Electrical Company, Superior, Wis., in order that its business title correspond to the caption borne by its special electrical devices now manufactured and marketed in large quantities and named after the inventor, M. B. Benson, president, has changed its name and will hereafter be known as the **Benson Electric Company.** In addition to its local establishment at Superior, Wis., the Benson Electric Company has offices and factories at Duluth, Brooklyn, Buffalo and New York. The main business of the company is electrical contracting, wiring of vessels, installation of power machinery and substations for docks and electrifying elevators and factories, lighting systems for buildings; and building, repairing, recharging and assembling storage batteries. The company is also a jobber of motors, generators, transformers, switchboards and general electric supplies. The local factory does all the wiring of vessels built at the shipyards at the head of the lakes. A number of special devices invented by Mr. Benson are also manufactured by this concern, among which is the Benson flashlight and electric whistle, now installed on 50 vessels on the Great Lakes and the Atlantic. This is a brilliant light in the form of a letter or monogram designating the fleet to which the vessel belongs, which flashes simultaneously with the sounding of the whistle and assures captains of correctness of signals. Another device made at the factory is the Superior non-glare floodlight, designed to contribute to the safety of workingmen on night construction. Numerous other devices are produced by the company, including the Benson recording compass, rotary switch and the electric telemotor, the latter of which is now being built for the United States government.

The Ohio Electric & Controller Company, 822 Citizens building, Cleveland, is now the name of the corporation formerly known as the Cleveland Controller & Manufacturing Company.

Anaconda Copper Mining Company, Great Falls, Mont., expects to have its new electrically operated copper rod and wire mill in operation by May 1. The plant will cost more than $500,000 and will have a capacity of 200,000 pounds of copper rods and 85,000 pounds of copper wire.

Vanderbeck, Hodson & Ryan, Inc., Finance building, Philadelphia, Pa., has recently been appointed as engineer for the Philadelphia Electric Steel Corporation, which is erecting its plant at Conshohocken, Pa. The first buildings of the plant are now in course of erection and a furnace is about to be installed. The company's principal business for the time being will be the production of high grade steel ingots for forging. Vanderbeck, Hodson & Ryan, Inc., will act as engineering advisers during the period of two years, having full charge of metallurgical supervision, design of buildings and layout of plants.

Wheeler Condenser & Engineering Company, Carteret, N. J., announces the publication of the fourth edition of its handbook entitled "Steam Tables for Condenser Work." This handbook is very complete and has met with great success, one reason for which is that the pressures below atmosphere are expressed in inches of mercury referred to a 30-inch barometer. It includes a discussion of the mercury column, the errors in such measurements and constants for their correction. A complimentary copy of the handbook will be furnished upon request to those occupying responsible positions, who are not yet provided with a copy and who deal with steam and its many problems.

The Jeffrey Manufacturing Company, Columbus, Ohio, has issued a well illustrated catalog of its storage battery locomotives. These are made in various sizes, the largest of which is designed for shifting regular freight cars in industrial plants, the smallest for operation on a track with a gauge of 20 inches. These locomotives are well adapted to moving materials in factories. The storage battery has been standardized so that it is now considered a reliable source of power. The cost of operation is slightly more than that of a trolley system. The battery system is much more flexible and may be used in many places where it is not practicable to install a trolley wire or a third rail. A copy of this catalog will be furnished by the company upon request.

How Westinghouse Electric Feeds Its Girls.—In line with its policy of providing dining facilities for the women in its East Pittsburgh offices, the Westinghouse Electric & Manufacturing Company recently erected and equipped a dining room where they may secure lunch at reasonable prices and tea, coffee and milk, free of charge. The architectural design is that of a mezzanine floor above one of the shop sections, which is readily accessible to the main offices. The new room is light, airy and attractive, and its whole construction and appearance is such as to make the enjoyment of the girls' midday luncheon the very highest. It was designed for and is operated as a cafeteria, the main idea being that of self-service.

The dining room is designed to seat 518 people at one time and each day is patronized by 1000 girls, coming in different shifts. The kitchen is scrupulously clean and neat in appearance, and is provided with the modern devices for labor saving. An elevator from the ground floor greatly facilitates the handling of provisions and refuse. Lighting and ventilating systems add to the comfort of the room. To give an idea of the extent to which the Westinghouse company has gone in supplying these facilities, it may be mentioned that the cost of the dining room completely equipped was approximately $30,000, some of which was, however, due to the labor involved in changing the location of water and steam pipes.

Recent Patents

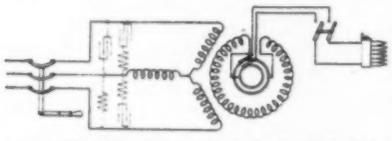
Selected and Summarized by Albert Scheible, Patent Attorney, 79 West Monroe Street, Chicago, Illinois

A series of brief comments on some of the recently issued electrical patents which appear to be of particular interest to our readers, the number after each heading being that of the United States patent to which the summary relates. Any correspondence regarding such patent matters should be sent direct to Mr. Scheible at the above address.

Rotary Converters (1,257,977 and 1,257,979).—These patents, both assigned by Lewis W. Chubb to the Westinghouse Electric & Mfg. Co., describe a six-phase and a twelve-phase rotary converter. In the former, the field windings are overexcited to produce a power factor other than unity with a leading current, while the armature is supplied both with an alternating current of a certain frequency and with a cosine component of alternating current. The latter has a frequency which is an odd multiple of that of the supply current, and is of such a magnitude as to equalize the heating in the tap coils.

In the second patent, a sine component of current of three times the supply frequency is circulated through a portion of the armature winding of a twelve-phase rotary converter.

Protecting Induction Motors and Transformers (1,255,387).—To prevent damage to the insulation of inductive devices by the high-voltage impulses generated within them when they are disconnected from the conductors of a distributing circuit, Lewis W. Chubb inserts energy-absorbing means between such apparatus and the disconnecting switch. For this



No. 1,255,387.—Protecting Induction Motors and Transformers.

purpose he uses a condenser and a resistor connected in series across the terminals of the apparatus which is to be protected, and a reactor connected in shunt with the condenser. These elements are so proportioned that they form a parallel resonant path across the terminals of the apparatus under normal conditions, and form a series resonant path for the higher frequencies induced when the switch is opened. The patent stands assigned to the Westinghouse Electric & Mfg. Co.

Switch Casing (1,258,010).—According to this patent, assigned by Henry D. James of Edgewood Park, Pa., to the Westinghouse Electric & Mfg. Co., the switch is mounted close to the door of the casing, and a part of the switch mechanism engages a cam on the door.

Electric Faucet-Heater (1,252,661).—Howard K. Clover, of Los Angeles, has assigned to the Electrical Products Corporation, of Wilmington, Del., this patent on a water heater for household use, in which the valve handle controls both the flow of water and the connections to a heating coil. The mechanism is so arranged that the heating element can be removed while leaving the valve on its seat to check the flow of water.

Circuit Protector (1,252,919).—To protect a split-phase induction motor in case the starting winding remains in circuit too long. Frank A. MacCallum, of Brookline, Mass., connects an electric heating coil in series with this winding and plates this coil close to a fuse in the main circuit. Ordinarily, the heating coil does not become sufficiently warm to affect the fuse, but if the starting current continues unduly, the heat of the coil rises to a point where it blows the fuse.

Radiotelephony (1,258,548).—To prevent the radiation of an unmodulated component of signaling wave, Carl R. Englund (of East Orange, N. J.) superposes on the wave an unmodulated wave of equal value but opposite in phase, after which the resulting oscillations are amplified and transmitted. The patent stands assigned to the Western Electric Company.

Producing Electric Heaters (1,256,599).—Instead of winding a metal wire or strip on an insulating tube, Max Ulrich Schoop (of Hoengg, Switzerland) plates a metal spiral on this tube. To do this, he rotates the tube in a lathe and projects the metal spray from a moving tool-holder through guard plates which keep the spray from widening out.

Attachment Plug (1,259,609).—To relieve the strains at the points where the wires are attached to the contact clips of an attachment plug, Harry W. Denhard, of San Francisco (in a patent assigned to the Cutler-Hammer Mfg. Co., of Milwaukee) twines both conductors around two studs formed in the two-piece insulating body of the plug.

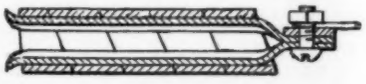
No. 1,259,609.—Attachment Plug.

Electric Hair Drier (1,259,170).—A small and portable fan is mounted in a casing which has a nozzle through which the air is ejected, and heating units are mounted in a double ladder-like arrangement within this nozzle. The patent (applied for in 1911) was assigned by Walter G. Trautman of Cleveland, Ohio, to the P. A. Geier Co. of the same city.

Cigar Lighter (1,256,571).—An electric cigar lighter shaped like a fuse plug is shown in this patent, assigned by William K. Kearsley, Jr. (of Newark, N. J.) to the General Electric Co. It consists of a shell filled with cement and having the usual Edison screw terminals connected by a resistance wire which is formed into a heating coil beyond the exposed surface of the cement.

Curtain Shade Circuit-Closer (1,259,736).—Under this title, John Havran, of Portland, Ore., has patented a shade-roller outfit so arranged that a rotation of the roller closes a circuit.

Connector (1,259,752). — A novel type of connector element, devised by Guy M. Laird, of Chicago, consists simply of a flat strip of spring metal



No. 1,259,752.—Connector.

wound into a spiral so as to form a tube. Contact pieces may be fastened inside this tube so as to form a clip.

Holder for Furnace Electrodes (1,259,842).—To prevent an overheating of the holder for the electrode of an electric furnace, Paolo Fischer, of Chicago, makes this holder hollow and provides it with a water jacket, so that water can flow continually both through and around the shank of the holder.

Insulating Terminal (1,259,386).—This is an electrical insulator comprising a built-up column of metal disks and insulating disks alternating to form a series of condensers and decreasing in size at a logarithmic ratio from a middle point. The patent, issued to Charles Le G. Fortescue, stands assigned to the Westinghouse Electric & Mfg. Co.

Arc Lamp (1,259,420).—A condensing chamber above the globe of the lamp is so partitioned off as to divide the arc gases into a number of separate drafts and to direct them toward a common point from positions above the arc, so that the gases tend to center and stabilize the arc. Patent assigned by George M. Little to the Westinghouse Electric & Mfg. Co.

Men in Service

Ainslie A. Gray Commissioned Major—G. A. Clark Joins Quartermaster's Corps—Commonwealth Edison Honor Roll

JAMES BROWN, of the Chicago office of H. M. Byllesby & Company, has enlisted in the gas bomb division of the Ordnance Department.

ENGINEERS' SOCIETY OF WESTERN PENNSYLVANIA now carries on its roll of honor the names of 49 members, who have enlisted in various branches of government service.

C. G. ENGSTROM, of the Hutchinson, Minn., division of the Northern States Power Company, formerly a captain of the South Dakota National Guard, has been selected as drill master for the Hutchinson Home Guard.

C. N. JAMES, formerly engineer of overhead construction of the St. Petersburg & Gulf Railway, St. Petersburg, Fla., was recently appointed a sergeant with the Fourth Company, Coast Artillery stationed at Fort Dade, Fla. Mr. James plans to enter the school for electrician sergeants at Fortress Monroe, Va.

A. Z. HADLEY, for a number of years connected with the Clearwater Telephone Lines, Orifino, Ida., is now a member of Company C of the 316th Field Battalion of the United States Signal Corps and is stationed at Camp Lewis, Tacoma, Wash.

COMMONWEALTH EDISON COMPANY, Chicago, has since the declaration of war by the United States on April 6, 1917, released 711 of its employees for military service. In the April 6 issue of the Edison Round Table several pages are devoted to the Edison roll of honor, giving the names, rank and address of those of its men now serving in various branches of government service.

AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS in the 1918 edition of its Year Book designates the names of members who are in the army or navy of the United States or allied nations by a special entry. The total number of members in the uniformed service, including those of which notice was received after the Year Book went to press and up to April 1, is 760, which is over 8 per cent of the total membership, now in excess of 9200.

GLENN A. CLARK, formerly secretary-treasurer of the Western Red Cedar Association, is now serving in the Quartermaster's Corps at Camp Joseph E. Johnston, Jacksonville, Fla. At the annual meeting of the association held recently, the newly elected president was requested to send the following telegram to Mr. Clark: "The Western Red Cedar Association convened at Spokane today. Regret that it was necessary to accept your resignation but proud of the fact that you are serving Uncle Sam in a good cause. A motion was unanimously passed instructing me to inform you that the entire membership send their kindest regards, and wish you success. Trust the Kaiser will soon have to take to the tall timbers, and that you will be back here again where the tall poles grow."

ROLL OF HONOR.

The electrical industry, perhaps to a greater extent than any other industry, has answered the call of the Nation for Men. As this is a war of engineers, naturally the technically trained men in the electrical industry have been in great demand and they have responded with splendid patriotism. Many of the large utility and industrial corporations have assigned men for Government service aside from those who have voluntarily entered or been called for service.

THE ELECTRICAL REVIEW *will welcome news concerning men who have entered the service or who are engaged in any patriotic duties.*

AINSLIE A. GRAY, formerly vice-president and general manager of the Electrical Review Publishing Company, Inc., and more recently with the firm of Gray & Benjamin, advertising specialists, Chicago, has been commissioned major in the ordnance reserve corps and will have charge of a new publicity bureau that will endeavor to co-ordinate the activities of the ordnance department and the industries, through the medium of the technical and trade press. Major Gray, who left for Washington on April 7, is eminently fitted for his new duties, having been actively engaged in the publishing business for the past 15 years. He is a native of Brooklyn, where he attended the public schools and later the evening classes of Cooper Union and Columbia University, thus preparing himself for both scientific and literary pursuits. Special attention was given during his later educational training to literary and journalistic work.

Major Gray joined the staff of the ELECTRICAL REVIEW in 1902. His promotion was rapid, he becoming managing editor in 1905. When the Electrical Review Publishing Company purchased the Western Electrician, he became managing editor of this consolidated paper and came to Chicago to take charge of the combined editorial departments. In 1909 he also became general manager of the company, and in 1914 was elected vice-president. Major Gray has been very active in numerous electrical organizations, including the Jovian Order and the Electric Club-Jovian League of Chicago. He was made vice-president of the Chicago Trade Press Association in 1913, and the following year became its president. In 1915 he was elected president of the Federation of Trade Press Associations, which was the national association of this industry. In March, 1916, this body was reorganized as the Associated Business Papers, Inc., Major Gray taking a prominent part in this reorganization and remaining its president until last year. Last June he resigned from the Electrical Review Publishing Company to enter the firm of Gray & Benjamin, which he now leaves to take up this important publicity work, which no doubt will aid materially in stimulating and co-ordinating the nation's enormous task in the manufacture of munitions.

LIEUT. FRED B. HANCHETT, of the U. S. Coast Artillery has been ordered to duty at Portland, Ore., and left Chicago on April 6 for that post. Lieut. Hanchett before entering the army was associate editor of the ELECTRICAL REVIEW.

E. K. MACDONALD, formerly of the bond department of H. M. Byllesby & Company, Chicago, who has been in the aviation section of the Signal Corps since last summer, has been appointed first lieutenant.

VERNE MOON and ELMER MORRIS, of Northern States Power Company, Minot (N. D.) division, have enlisted in the signal section of the Aviation Service and have reported at Vancouver, Wash.

R. W. SPOFFORD, general manager of the Augusta-Aiken Railway & Electric Corporation, Augusta, Ga., who is a retired officer of the United States Navy, has been called to active service. W. C. Callaghan succeeds him as general manager. Mr. Callaghan has been with The J. G. White Management organization, New York City, the operators of the Augusta company, since 1913.

COLLEGE OF ENGINEERING of the University of Wisconsin, Madison, Wis., in the March issue of the Wisconsin Engineer publishes a supplementary honor roll which bears the following names of students or graduates of the institution, who have answered the call to the colors: Kendall B. Bragg, G. E. Bachhuber, H. A. Camlin, Bernard M. Conaty, Robert M. Connelly, E. W. Fisher, A. P. Gockel, Charles J. Goldhammer, Carl F. Hayden, Arly L. Hedrick and William T. Hopkins.

Obituary.

CAPT. HENRY N. BROOKS of the 308th Engineers in France recently died of pneumonia, according to a cablegram received. Captain Brooks went to France last December, and was located in a small French village as engineer depot officer in charge of a large and important engineer supply depot. He was a graduate of the engineering college of Cornell University, and was one of the pioneers in the electrical railway engineering field. One of his first jobs was the electrification of horse car lines in Philadelphia in 1892, and was later associated with the Westinghouse Electric & Manufacturing Company. He was for a number of years assistant electrical engineer with the firm of Sargent & Lundy, and for the last two years had been associated with James N. Hatch, consulting engineer on public utility work, Chicago.

Personal

R. S. Blake to Represent Duquesne Electric—Gov. Bamberger Active in Liberty Loan Campaign—Other Changes

CLARENCE P. KING, president of the Washington Railway & Electric Company, Washington, D. C., has resigned.

J. H. GALT, Trenton, N. J., has been appointed assistant engineer of distribution for the Public Service Corporation, for the southern division, Camden.

A. M. HARVILLE, manager of the Cumberland Telephone & Telegraph Company, Elizabethtown, Ky., has accepted a similar position at Eminence, Ky.

N. I. GARRISON, manager of the El Reno division of the Oklahoma Gas & Electric Company, has been appointed one of a committee of four to supervise the El Reno war gardens.

T. KAARBURG, formerly connected with the electric construction department of the Rochester Railway & Light Company, Rochester, N. Y., has accepted a position with the Detroit Edison Company.

A. G. CARSON, who recently resigned as general manager of the Eastern Wisconsin Electric Company, Fond du Lac, Wis., has become assistant to the vice-president, C. R. Phenicie, of the C. C. Smith public utilities in Wisconsin, with headquarters at Manitowoc.

C. B. STROHN has been elected vice-president of the Western United Gas & Electric Company, Aurora, Ill., to succeed his brother, R. N. Strohn, who has been in England for several months doing Red Cross work. Other officers re-elected were Ira C. Copley, president; Fred Bennett, secretary, and H. O'Meara, first assistant treasurer. C. B. Strohn also serves as second assistant treasurer.

GOVERNOR SIMON BAMBERGER, of Utah, heavily interested in public utilities, is a prominent factor in the Liberty Loan speaking campaign for Michigan, having recently been booked at patriotic meetings held in Flint, Williamston and Grand Rapids. Governor Bamberger is the first non-Mormon and democrat elected governor of the state since Utah was admitted to the Union in 1896. He is a staunch supporter of the President in the war, and has brought up the resources of his state in the way of men and money behind the war to the highest point of efficiency.

FRANK W. FRUEAUFF, vice-president of Henry L. Doherty & Company, New York City, on Friday evening, March 29, celebrated his forty-fourth birthday at Delmonico's as the guest of 125 friends, the majority of whom were business associates. On the occasion Mr. Frueauff was presented with a gift, consisting of a rare and handsomely bound copy of "The Pilgrim's Progress," which contained extra fly-leaves recording the signatures of all those present. More than fifty telegrams, chiefly from the various Doherty properties extending their sincere greetings, were received by him.

SAMUEL INSULL, president of the Commonwealth Edison Company, Chicago, and chairman of the State Council of Defense, received word on April 8 of the death of his mother, Mrs. Emma Insull of London, who passed away on April 5. Mrs. Insull was in her eighty-fourth year and is survived by her husband and five children.

ROBERT S. BLAKE has established a Chicago branch office for the Duquesne Electric & Manufacturing Company, Pittsburgh, Pa., at 230 South La Salle street. Mr. Blake is well known in the electrical industry, having formed a large acquaintance through his former connection with the Condit Electrical

Robert S. Blake.

Manufacturing Company both in Boston and in Pittsburgh, in which latter city he acted as district manager. The combination of his sales and engineering experience qualify him to give exceptional service in handling his present line of new and used electrical equipment. Mr. Blake is a member of the Association of Iron and Steel Electrical Engineers.

W. P. HOAGLAND has been appointed sales manager of the Chicago office of the Western Electric Company. He has been connected with the Chicago house since September, 1900, and since 1911 has been head of the supply sales work.

TRACY A. JOHNSON was recently elected vice-president in charge of finance and a director of the United Gas & Electric Corporation, and has also been appointed a member of the finance committee. Mr. Johnson was formerly a member of the firm of Rhoades & Company.

HENRY GALE has succeeded L. D. Gray as superintendent of Freeport district for the Illinois Northern Utilities Company, the latter having entered the National Army. Mr. Gray has been in the employ of this company many years, much of the time in the electric railway department.

N. N. BUCK, formerly manager of the Ellsworth Heat, Light & Power Company, Ellsworth, Wis., has become associated with the Wisconsin-Minnesota Light & Power Company.

CLYDE HUNTER, chief clerk in the commercial department of the Southwestern Telegraph & Telephone Company, Waxahachie, Texas, has been promoted to the position of manager.

ELMER DOVER, vice-president of H. M. Byllesby & Company, with headquarters at Tacoma, Wash., has been appointed general chairman of the Third Liberty Loan Campaign for the district of Tacoma.

M. LUCKIESH, of the Nela Research Laboratory, Cleveland, Ohio, tendered an interesting address on "The Aesthetics of Street Lighting" at a meeting of the Illuminating Engineering Society held recently.

JAMES W. MOREY, until recently manager of the New York branch of the Multi-Refillable Fuse Company, has joined the staff of Hatheway & Knott, Inc., New York City, and will travel the southern territory of Pennsylvania.

J. D. KENNEDY, manager of the Philadelphia house of the Western Electric Company, has become assistant contract sales manager of the Hawthorne (Ill.) plant of the company and will have charge of the general sales department.

E. C. DEAL was recently appointed general manager of the Springfield Gas & Electric Company and the Springfield Traction Company of Springfield, Mo., both of which concerns are controlled by the Federal Light & Traction Company.

H. C. WHITE, Thomasboro, Ill., has been appointed traveling representative for the Western Electric Company in northern Illinois and southern Iowa. Mr. White will have particular interest in the farm lighting and power plants manufactured and sold by the Western Electric Company. He has been a salesman for the company in Champaign county, Ill., for the past year. Mr. White has also served as custodian for the Champaign County Electric Company, operating a plant at Thomasboro, Ill., and formerly was connected with the Kankakee & Urbana Traction Company, Urbana, Ill.

Obituary.

E. L. NOEL, of the electrical contracting firm of Hubbard & Noel, 1244 Wood avenue, Kansas City, Mo., was instantly killed when his automobile was overturned on the road near Plymouth, Kans., nine miles from Emporia, Kans. The firm of Hubbard & Noel was opening a new branch electrical house at Wichita, Kans., and Mr. Noel was on his way to Wichita to attend to matters incident to its installation when the fatal accident occurred. His home was at 1909 North Twelfth street, Kansas City, Kans.

Financial News

Annual Report Northern States Power Company.

After sustaining a difficult year without loss in net earnings, officers of Northern States Power Company are looking for better results in 1918, as stated in the annual report just issued. While the company materially increased its business, increased coal and labor costs and higher taxes made serious inroads on its net earnings last year. Regarding conditions at present the report says:

"Increased rates for service became effective January 1, 1918, in many of the communities served; better water conditions now prevail, and all of the hydroelectric plants are again in operation. It is believed that fuel conditions will improve. It is also expected that the contract which the Northern States Power Company has with the Wisconsin-Minnesota Light & Power Company will provide a large additional amount of hydroelectric power during this and future years. All of these factors have an important bearing on your company's net earnings. The company has been constantly enlarging the territory reached by its transmission lines, and has taken on many new contracts. With the return of normal operating conditions, these additions should be increasingsly profitable."

Earnings for 1917 and 1916 compare as follows:

	1917.	1916.
Gross earnings	$7,154,508.89	$6,087,153.16
Operating expenses and taxes	3,764,728.39	2,745,496.26
Net earnings	3,389,780.50	3,341,656.90
Interest charges	1,709,837.74	1,593,127.79
Balance	1,679,942.76	1,748,529.11
Preferred dividends	916,011.05	740,236.39
Balance available for amortizations, depreciation and common dividends	763,931.71	1,008,292.72

In view of the customary allowances for depreciation and amortization, aggregating $575,000, it was necessary to draw on previously accumulated surplus for $240,970 of the common stock dividends paid during the year. Net earnings after interest charges were 1.83 times the dividend requirements on the 7 per cent preferred stock.

The placing of the securities of the company among citizens in Minneapolis, St. Paul and the 170 other communities served in the central Northwest, was continued with increasing success. As of March 25, 1918, total sales of preferred stock in home territory amounted to 5,425, aggregating $2,774,000 par value of stock.

Kansas City Railway Dividends.

The Kansas City Railways Company will pass the 1918 dividend upon the preferred stock owing to the enormous increase in operating expenses. The company has paid three semi-annual dividends on its preferred stock since its reorganization, amounting to $470,320. For the year ended June 30, 1917, the company's total operating revenue was $7,048,019 and the net divisible income was $2,415,076, of which amount $411,302 was paid to the city of Kansas City and the balance accrued to the company. Out of this sum interest charges took $1,442,568 and other deductions $30,064, leaving a net income of $530,741, of which amount $313,580 was paid in dividends at that time.

Hudson Power to Issue Stock.

The Public Service Commission has authorized the Hudson Power Corporation to issue $15,000 par value of its common stock. The commission also authorized the Albany Southern Railroad Company, the Central Hudson Gas & Electric Company and the Kingston Gas & Electric Company each to acquire and hold $5000 of the stock issued. The company was incorporated to construct a power plant on the Wallkill river near Rifton, N. Y.

Dayton Power & Light Bonds.

The Ohio Public Utilities Commission has granted permission to the Dayton Power & Light Company to issue $1,750,000 7 per cent two-year bonds. The company will discharge its floating indebtedness of $1,454,022 for the years 1916 and 1917, $185,954 will be spent at the Millers Ford power station and make additions to its Xenia transmission lines.

Light Plant Makes Money.

The revenues of the Seattle lighting department for 1917 were $1,329,808.97 and expenditures $945,254.80. Expenditures included $802,590.27 for operating expenses, $110,746.21 for interest, $9,986.08 for miscellaneous items, $6,155.16 for other losses and $15,777.08 for redemption and depreciation. These figures are given in the report of Superintendent of Lighting J. D. Ross, recently issued.

Electric Boat's Profits Show Decrease.

The net profits of the Electric Boat Company, the principal subsidiary of the Submarine Boat Corporation, in 1917, were $2,370,587, against $7,012,084 in the preceding year; the surplus after dividends was $2,080,038, compared with $1,876,189 in 1916. During the year $1,168,094 was written off on account of the reduction in market price of Russian rubles due the company for submarines shipped to Russia. The net income of the Submarine Boat Corporation for the year was $1,248,099, equal to $1.63 a share on the 764,810 shares of stock outstanding. Dividends paid amounted to $1,147,215.

Standard Gas & Electric Report.

Standard Gas & Electric Company has issued its report for the year ended December 31, 1917, showing a surplus of $873,305 after charges, against $1,186,294 surplus for 1916. Gross revenue was $1,620,343, a decrease of $92,584, as compared with the preceding year. Combined gross earnings of the company and subsidiaries for 1917 totaled $19,341,587 and net earnings were $8,523,326, as against $17,127,134 gross and $8,309,422 net for 1916.

Income account of the Standard Gas & Electric Company for year ended December 31, 1917, compares as follows:

	1917.	1916.
Gross revenue	$1,620,343	$1,712,927
Net revenue	1,566,051	1,664,199
Other income	100,000	311,857
Total income	$1,666,051	$1,976,056
Surplus after charges	*873,305	1,186,294
Preferred dividends	707,097	549,964
Amort. debt discount	55,000	55,000
Balance	$ 111,208	$ 581,330

*Equal to 7.41 per cent on $11,784,950 preferred stock, as compared with 10.06 per cent earned in 1916.

Combined earnings of the subsidiaries for years ended December 31, compare as follows:

	1917.	1916.
Gross revenue	$19,341,587	$17,127,134
Net revenue	8,523,326	8,309,422
Balance of earnings retained in surplus	946,599	1,073,225

Arthur S. Huey, vice-president of the company, addressing the stockholders calls attention to the high standard of physical upkeep and maintenance of all of the subsidiary companies' properties. "The plants and distributing systems have been substantially constructed and with additions to capacity as from time to time required, are adequate to meet the demands for service," he says. The rapidly increasing demands on many of the properties will require supplies of new capital. In view of the excellent earnings record of the properties and the highly essential character of the service performed, together with the good financial condition of the Standard Gas & Electric Company, it is believed that no extraordinary difficulties will be encountered in providing funds for necessary construction.

March Copper Dividends.

Copper mining companies paid out to their stockholders during March dividends approximating $20,000,000, an amount lower than in December and also under a year ago. In those months disbursements were $23,870,588 and $21,264,834 respectively. During the first quarter of this year copper share dividends will have approximated $37,700,000.

Northern Ohio Traction & Light Stock.

The Northern Ohio Traction & Light Company has issued $9,100,000 of common stock, nearly all of which is owned by the Northern Ohio Electric; also $4,990,000 of preferred stock, $4,443,000 of refunding bonds, and $1,000,000 of notes secured by deposit of refunding bonds. There are also outstanding $9,600,000 of underlying bonds. Dividends of 6 per cent a year are paid on the preferred stock, on common dividends started in 1906, and gradually increased to a 5 per cent rate in 1913. This continued till August, 1917, when 1½ per cent was paid instead of 1¼.

1918 Revenue Estimate of Western Utility Shows Deficiency.

In presenting its case for an increase of 20 per cent in rates for electricity, the Pacific Gas & Electric Company recently informed the Railroad Commission that the 1917 value of its properties was $105,936,011.78, the principal segregations being: Electric and water departments, $61,046,541.36; gas department, $27,856,113.46; railways, $2,057,981.41. The company contends that its gas net income in 1918 will be deficient as compared with 1916 to the amount of $503,000, and that there will be a deficiency in its electric net income of $1,863,053.

Union Light & Power Bonds Offered.

A syndicate composed of the Third National Bank, the Mercantile Trust Company and the Mississippi Valley Trust Company is offering for sale $1,000,000 of two-year 6 per cent bond secured gold notes of the Union Electric Light & Power Company of St. Louis, Mo. The bonds are dated March 15, 1918, and are due March 15, 1920. The bonds are issued in denominations of $1000, coupon form, and are subject to redemption at 101 and accrued interest. The authorization is for $2,000,000 and the present issue is for one-half that amount. They are secured by a deposit with the trustee of the Union Electric Light & Power Company, of St. Louis, refunding and extension mortgage 5 per cent mortgage gold bonds due May 1, 1933, in the ratio of $150 par value of bonds to each $100 of notes represented. The price at which the notes are offered is 97¾ and accrued interest to yield 7¼ per cent.

Seattle Securities.

Authorization is asked of the federal government for the sale of $6,640,000 of Seattle securities in a resolution introduced in the city council. This action is in compliance with the request of the government that before the bonds are offered for sale that the need of issuance be passed upon by the capital issues committee of the Federal Reserve Board. In the event this board finds that the issuance and sale of any particular bond issue is not incompatible with the interest of the United States, their sale will be approved by the committee.

The approval of this committee will be asked for, including $5,090,000 of lighting utility bonds for the construction of a completed hydroelectric plant, transmission line and substation; $500,000 of the $3,700,000 water utility bonds authorized for extensions and betterments of the Cedar river water supply system; $300,000 to retire condemnation judgments awarded for property taken for a regrade of the north end of Beacon Hill; $350,000 of general bonds authorized at the recent election for the construction of an elevated electric railway along the water front and other smaller issues.

Dividends.

Manhattan Traction, Light & Power Company has declared a quarterly dividend of 2 per cent, payable April 15 to stock of record April 1.

Milwaukee Electric Railway & Light Company has declared a quarterly dividend of 1½ per cent on preferred stock, payable April 30 to stock of record April 20.

Arkansas Light & Power Company declared the regular quarterly dividend of 1¾ per cent on the preferred stock.

Anaconda Copper Mining Company has declared a dividend of $2 per share, payable May 27 to stock of record April 20.

Westinghouse Electric & Manufacturing Company has declared the regular quarterly dividends of 1¾ per cent on common and preferred stocks. The latter is payable April 15 to stockholders of record April 4 and the common on April 30 to stockholders of record April 4.

Nevada-California Electric Company has declared a dividend of $1.75 on preferred stock, payable April 30 to stock of record March 30.

Western States Gas & Electric Company has declared a quarterly dividend of 1¾ per cent on preferred stock, payable April 15 to stock of record March 20.

American Light & Traction Company has declared a dividend of 1½ per cent on preferred stock, payable May 1 to stock of record April 11.

Pennsylvania Lighting Company has declared a quarterly dividend of 1¼ per cent, payable April 15 to stock of record April 8.

Massachusetts Light Company has declared a dividend of $1.50 per share on preferred and 25 cents per share on common stock, payable April 15 to stockholders of record March 25.

West Penn Power Company has declared a quarterly dividend of 1¾ per cent on its preferred stock, payable May 1 to stock of record April 20.

Pacific Telephone & Telegraph Company has declared a quarterly dividend of 1½ per cent on its preferred stock, payable April 15 to stock of record March 31.

The directors of the Inspiration Consolidated Copper Company have declared a dividend of $2.00 per share, payable April 29 to stockholders of record April 12.

Earnings.

NEW ENGLAND POWER COMPANY SYSTEM.

	1917.	1916.
December gross	$ 267,515	$ 210,726
Net after taxes	108,435	140,796
Surplus after charges	590,048	91,251
12 months' gross	2,645,973	2,068,436
Net after taxes	1,144,195	1,311,132
Surplus after charges	546,450	711,670

COLUMBIA GAS & ELECTRIC COMPANY.

	1918.	1917.
February gross	$1,178,033	$1,051,698
Net after taxes	612,949	577,308
Surplus after charges	425,765	376,503
12 months' gross	11,123,332	9,452,971
Net after taxes	5,338,788	4,685,398
Surplus after charges	2,977,146	1,608,179

TWIN CITY RAPID TRANSIT COMPANY.

	1918.	1917.
February gross	$ 780,372	$ 827,373
Net after taxes	175,838	250,515
Surplus after charges	30,919	114,903
2 months' gross	1,622,096	1,725,306
Net after taxes	355,398	536,286
Surplus after charges	49,963	251,311

ADIRONDACK ELECTRIC POWER COMPANY.

The Adirondack Electric Power Company reports for the year ended December 31, 1917:

	1917	1916
Gross earnings	$1,650,765	$1,512,516
Net earnings	418,584	565,152
Surplus	162,558	306,864

BANGOR RAILWAY & ELECTRIC COMPANY.

Earnings of the Bangor Railway & Electric Company for January and 12 months follow:

	1918.	1917.
January gross	$ 77,776	$ 74,684
Net	$ 27,607	$ 31,772
Interest, etc.	19,659	18,725
Surplus	7,948	13,047
12 months' gross	889,212	838,388
Net	$379,902	$369,247
Interest, etc.	229,376	215,924
Preferred stock dividend	105,000	105,000
Balance	45,526	48,323

PORTLAND RAILWAY, LIGHT & POWER COMPANY.

E. W. Clark & Company furnish the following statement of earnings of the Portland Railway, Light & Power Company (Portland, Oregon) for January and 12 months:

	1918.	1917.
January gross	$ 594,020	$ 512,594
Net	254,842	254,892
Interest, etc	179,036	183,084
Surplus	75,806	71,808
12 months' gross	6,023,510	5,483,110
Net	2,446,917	2,444,856
Interest, etc.	2,152,052	2,178,258
Surplus	294,865	266,598

NEWPORT NEWS & HAMPTON RAILWAY GAS & ELECTRIC COMPANY.

Newport News & Hampton Railway Gas & Electric Company for the 12 months ending December 31, 1917, reports as follows:

	1917.	1916.
Gross earnings	$1,257,307	$1,013,711
Net earnings after taxes	540,283	419,650
Surplus after charges	287,283	188,432

NORTHERN OHIO ELECTRIC CORPORATION.

	1918.
February gross	$ 533,095
Net after taxes	176,030
Surplus after charges	35,535
12 months' gross	6,570,047
Net after taxes	2,405,308
Surplus after charges	852,364

KANSAS GAS & ELECTRIC COMPANY.

Kansas Gas & Electric Company reports for January:

	1918.
Gross earnings	$ 199,857
Expenses and taxes	132,644
Net earnings	$ 67,213
Interest charges	30,403
Net income	$ 36,810
12 months—	
Gross earnings	$1,777,625
Expenses and taxes	1,280,828
Net earnings	$ 496,797
Interest charges	285,993
Net income	$ 210,804
Preferred dividends	133,000
Balance	$ 77,804

EASTERN POWER & LIGHT CORPORATION.
(Subsidiaries.)

Below is given a comparative statement of the gross revenue for March, 1917, and March, 1918:

	1918.	1917.
Reading System	$301,122.16	$242,991.81
Pennsylvania Utility System	125,374.12	95,485.06
West Virginia System	91,799.37	83,296.34
Claremont System	31,597.00	24,192.13
Total	$549,893.15	$445,965.34

REPUBLIC RAILWAY & LIGHT COMPANY.

	1918.	1917.
January gross	$ 484,586	$ 379,782
Net after taxes	134,176	122,677
Surplus after charges	55,621	44,796
12 months' gross	4,994,719	4,049,083
Net after taxes	1,550,231	1,650,033
Surplus after charges	622,336	829,550

COLORADO POWER COMPANY.

	1918.	1917.
February gross	$ 100,198	$ 89,537
Net after taxes	56,186	52,741
Total income	57,333	53,796
12 months' gross	1,212,092	1,063,793
Net after taxes	693,531	592,879
Surplus after charges	383,462	304,117

WEEKLY COMPARISONS OF CLOSING-BID PRICES OF SECURITIES OF LEADING ELECTRICAL COMPANIES.

Quotations furnished by F. M. Zeller & Co., Rookery Bldg., Chicago.

Public Utilities—	Div. rate. Per cent.	Bid Apr. 2.	Bid Apr. 9.
Adirondack Electric Power of Glens Falls, common	6	15	14
Adirondack Electric Power of Glens Falls, preferred	6	69½	68½
American Gas & Electric of New York, common	10 +extra	88	87
American Gas & Electric of New York, preferred	6	40	40
American Light & Traction of New York, common	..	202	199
American Light & Traction of New York, preferred	6	95½	95½
American Power & Light of New York, common	4	45	40
American Power & Light of New York, preferred	6	73	73
American Public Utilities of Grand Rapids, common	..	20	20
American Public Utilities of Grand Rapids, preferred	6	53	50
American Telephone & Telegraph of New York	..	100¾	99½
American Water Works & Elec. of New York, common	..	4	4¾
American Water Works & Elec. of New York, particip	7	12½	12½
American Water Works & Elec. of New York, first preferred	..	58¼	58¼
Appalachian Power of Bluefield, common	..	2¼	2¼
Appalachian Power of Bluefield, preferred	7	20	20
Cities Service of New York, common	+extra	201	202
Cities Service of New York, preferred	6	74¾	75
Commonwealth Edison of Chicago	8	105	105
Comm. Power, Railway & Light of Jackson, common	..	23	22½
Comm. Power, Railway & Light of Jackson, preferred	6	47	47½
Federal Light & Traction of New York, common	..	6	6
Federal Light & Traction of New York, preferred	..	28	26
Illinois Northern Utilities of Dixon	6	70	..
Middle West Utilities of Chicago, common	2+extra	24	24½
Middle West Utilities of Chicago, preferred	6	56	56
Northern States Power of Chicago, common	ex.div.7	50	45
Northern States Power of Chicago, preferred	ex.div.7	80	84
Pacific Gas & Electric of San Francisco, common	..	35	33
Pacific Gas & Electric of San Francisco, preferred	6	79¾	79½
Public Service of Northern Illinois, Chicago, common	7	75	74
Public Service of Northern Illinois, Chicago, preferred	6	85	85
Republic Railway & Light of Youngstown, common	4	24¼	22½
Republic Railway & Light of Youngstown, preferred	6	59	57
Standard Gas & Electric of Chicago, common	..	4	4
Standard Gas & Electric of Chicago, preferred	6	23	23
Tennessee Railway, Light & Power of Chattanooga, common	..	2½	2½
Tennessee Railway, Light & Power of Chattanooga, preferred	6	8	8
United Light & Railways of Grand Rapids, common	4	29	28
United Light & Railways of Grand Rapids, preferred	6	60½	58
Western Power of San Francisco, common	..	12½	12½
Western Power of San Francisco, preferred	6	48	48
Western Union Telegraph of New York	extra	92	92½
Industrials—			
Electric Storage of Philadelphia, common	4	47	48
General Electric of Schenectady	8	138	137½
National Carbon of Cleveland, preferred	8	56	56½
National Carbon of Cleveland, common	..	130½	130¾
Westinghouse Electric & Mfg. of Pittsburgh, common	+extra	40	40⅛
Westinghouse Electric & Mfg. of Pittsburgh, preferred	7	59	59

*Last sale.